

**Building Partnerships
to support the
Mathematical Education of Teachers**

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Teacher education is a long-term, complex endeavor that requires the coordinated effort of people with very different backgrounds and agendas. Our goal today is to discuss the challenges related to coordinating those efforts and share ideas for how to successfully address those challenges.

Society expects our universities to make a major contribution to improving K-12 education and, in particular, K-12 mathematics education.

Investing in high quality teachers is the single most important thing we can do to improve K-12 mathematics learning.

Mathematicians should be part of the solution, because we have a lot to offer, and because our universities will expect us to contribute.

Historically

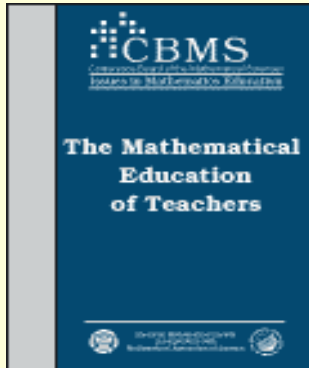
(before all of us got involved, of course)

There was very little communication and even less collaboration among faculty in education and in mathematics.

Faculty in Colleges of Education saw teacher education as exclusively their job. They taught pedagogy classes and educational psychology courses and certified teachers. They said that content knowledge was important, but their requirements often told a different story.

Mathematicians taught math classes with a focus on educating math majors for graduate school. They had little respect for their students who wanted to be teachers, especially students who wanted to be elementary teachers.

At least this was true at Nebraska.



Recommendation from The Mathematical Education of Teachers

- The mathematics education of teachers should be based on
 - **partnerships** between mathematicians, mathematics education faculty and school mathematics teachers.

Mathematicians cannot do it alone

Outstanding mathematics teaching requires interdisciplinary knowledge, including:

- Mathematical knowledge
- Pedagogical knowledge
- Knowledge of the students you teach

Mathematics teaching is an extraordinarily complex activity involving interactions among teachers, students, and the mathematics to be learned in real classrooms.

(National Math Panel, 2008)

The value added by a true collaboration with a mathematics educator cannot be overestimated.

Partnerships are difficult

- There are cultural differences

Why Can't a Woman, Be More Like a Man?

Professor Henry Higgins, My Fair Lady

- Sometimes there is a lack of respect

Anyone who cannot cope with mathematics is not fully human. At best he is a tolerable subhuman who has learned to wear shoes, bathe, and not make messes in the house.

A sign on the wall of Ron Graham's office in New Jersey as reported in an article about Erdos in The Atlantic Monthly, Nov.1987

What is so difficult about the preparation of mathematics teachers?

- Our universities do not adequately prepare mathematics teachers for their mathematical needs in the school classroom. Most teachers cannot bridge the gap between what we teach them in the undergraduate curriculum and what they teach in schools.
- We have not done nearly enough to help teachers understand the essential characteristics of mathematics: its precision, the ubiquity of logical reasoning, and its coherence as a discipline.
- The goal is not to help future teachers learn mathematics but to make them better teachers.

H. Wu, Professor, University of California, Berkeley

What is so difficult?

- The mathematics taught should be **connected as directly as possible to the classroom**. This is more important, the more abstract and powerful the principles are. Teachers cannot be expected to make the links on their own.
- Get teachers to believe, that mathematics is something you think about - that validity comes from inner conviction that things make sense, that mathematical situations can be reasoned about on the basis of a few basic principles.
- The goal is to have teachers develop flexibility in their thinking, to be able to reason about elementary mathematics.

Roger Howe, Professor, Yale University

Why involve mathematicians?

Because the mathematical knowledge of teachers matters

The essential competencies of an effective teacher are command of subject, preparation in effective pedagogical practice, and high overall academic performance.

To Touch the Future

American Council on Education

NM Context

- New Mexico is ranked 48th out of the 50 states in 8th grade math (NAEP)
- Minority-majority state with persistent achievement gaps
- Ranked 4th for percent of children living in poverty

More context

- Department of Mathematics
- Department of Teacher Education
- Local school district (65,000 students)
- Other school districts
- State licensure requirements

My changing focus

- Mathematics courses
- Professional development
 - Fully grant funded for 6 years
 - 600 teachers
 - 90% supported by the district
- State-wide organizations
- Mathematics courses

Fruitful partnerships

- Phase 1: none
- Local district
- COE
- PED
- Department/university

Current goals

- Streamline degree programs so that students can double major in mathematics and secondary education
- Improve coordination between instructors of elementary math and math methods courses
- Leverage resources across colleges to help students get early field experiences
- Create a community of undergraduates interested in mathematics teaching at all levels