Preparing Mathematics Teachers: AMTE’s New Standards

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American Mathematical Association of Two-Year Colleges

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Introductions

• Who are we?
• Experience with AMTE Standards?
• What are you hoping to get from this session?
Goals for Today’s Discussion

- **Motivation:** What knowledge, beliefs, skills and dispositions do effective teachers hold?
- **AMTE Standards:** A national vision for the initial preparation of those who teach mathematics Pre-K – 12
How to Obtain the Documents

www.amte.net/standards

Available on that webpage:

- *Standards for Preparing Teachers of Mathematics*
- Executive Summary
- Poster
- Videoclips
  - Randy Philipp
  - Rochelle Gutiérrez
  - Doug Clements

And more to come!
Standards for Preparing Teachers of Mathematics

www.amte.net/standards

Comprehensive, aspirational standards describing a national vision for the initial preparation of all teachers PreK-12 who teach mathematics.

Full Standards  Executive Summary  Poster
Mission Statement of Brookhill Institute of Mathematics:
Our mission is to provide K–12 teachers and higher education the opportunity to participate, collaborate, develop, and improve the teaching of mathematics.
AMTE’s **SPTM**

- A set of comprehensive standards describing a national vision for the *initial preparation* of all teachers Pre-K–12 who teach mathematics.
  - Includes all who have responsibility for aspects of student learning in mathematics.
- These standards are *aspirational*, rather than describing minimum levels of competency needed by beginning teachers.
- The audience includes all those involved in mathematics teacher preparation.
More About *SPTM*

- These standards **build on** other standards and recommendations, including *MET II*, NCTM’s *Principles to Actions*, *Common Core State Standards*, etc.
- These standards **inform but do not replace** state and national accreditation reviews, such as CAEP (Council for the Accreditation of Educator Preparation).
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Structure of the Document

Chapter | Focus
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1 | Assumptions & Overview

**Candidate Knowledge, Skills, and Dispositions**

2 | Program Characteristics to Develop Candidate Knowledge, Skills, and Dispositions

3 | Grade-Band Elaborations *(Early Childhood, Upper Elementary, Middle Level, and High School)*

4-7 | Grade-Band Elaborations *(Early Childhood, Upper Elementary, Middle Level, and High School)*

8 | Assessing Mathematics Teacher Preparation

9 | Enacting Effective Preparation of Teachers of Mathematics

Read through the standards on this page. Mark each:

Y: Yes, I am addressing this in my work.

P: I am Partially addressing this, but I’d like to address this more.

N: No, I am not responsible for addressing this.

?: Hm, should I be addressing this?
Let’s Consider a Task

• How many eggs would you have if you had 6 dozen eggs?
• After you find the answer one way, find another approach.
• Turn and share with a neighbor.
What Knowledge, Beliefs, Skills, and Dispositions do Teachers Need to be Effective?

Example, Javier, Grade 5

(Javier, VC #6, 0:00 - 1:10)
One Representation of Javier’s Thinking

\[ 6 \times 12 = (5 \times 12) + (1 \times 12) \quad \text{(Distributive property)} \]
\[ = [(\frac{1}{2} \times 10) \times 12] + 12 \quad \text{(Substitution property)} \]
\[ = [\frac{1}{2} \times (10 \times 12)] + 12 \quad \text{(Associative property)} \]
\[ = [\frac{1}{2} \times (120)] + 12 \]
\[ = 60 + 12 \]
\[ = 72 \]

Place value
What Knowledge, Beliefs, Skills, and Dispositions do Teachers Need to...

1. …understand Javier’s thinking?
2. …build on Javier’s thinking? For example, what follow-up questions might one ask of Javier to extend his thinking?
3. …evoke Javier’s thinking in a classroom?
4. …teach other students to reason like Javier?
5. …value Javier’s thinking?
6. …shift from a deficit view whereby immigrant and other “different” students are seen as lacking knowledge and instead view linguistic and cultural diversity as strengths?

Where do teachers learn this?
The Strands of Mathematical Proficiency

The Strands of Mathematical Proficiency

- Integrated and functional grasp of mathematical ideas
- The ability to formulate mathematical problems, represent them, and solve them.
- The capacity to think logically about the relationships among concepts and situations, including the ability to justify one’s reasoning both formally and informally.
- Knowledge of procedures, knowledge of when and how to use them appropriately, and skill in performing them flexibly, accurately, and efficiently.
- The tendency to see sense in mathematics, to perceive it as both useful and worthwhile, to believe that steady effort in learning mathematics pays off, and to see oneself as an effective learner and doer of mathematics.
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The Strands of Mathematical Proficiency

- Conceptual Understanding
- Strategic Competence
- Productive Disposition
- Procedural Fluency
- Adaptive Reasoning
Example of Mathematical Disposition

70
- 23
53

76
- 23
53

“Yes, math is like that sometimes.”
$6 - (-2) \Rightarrow 6 + +2$
Ally, End of Grade 5

An average 5th-grade student at a high-performing local school

• How did Ally come to hold these conceptions?
• What do teachers need to know to reduce the occurrence of these conceptions in their students?
Identify three "alternate" conceptions that, though not valid for these tasks, were mathematically valid in the past.
How must we prepare teachers so that their students develop all five strands of mathematical proficiency?
“Each person would get one fourth and they would get one … (pause) twelfth, and … (pause) added together they would each get one third?”

Felisha, End of Grade 4
Productive Mathematical Dispositions

• Key Ideas appear throughout indicators
• C.1.3: Exhibit Productive Mathematical Dispositions
• C.2: (Throughout)
• C.3.3: Anticipate and Attend to Students’ Mathematical Dispositions
• C.4.2: Cultivate Positive Identities
Productive Mathematical Dispositions

• Key Ideas appear throughout indicators

• [https://vimeo.com/219858789](https://vimeo.com/219858789)

• C.4.2: Cultivate Positive Identities
Enacting Effective Preparation of Teachers of Mathematics

• This document sets forth an ambitious but achievable vision to prepare teachers who can effectively support the mathematics learning of each and every student in grades Pre-K – 12 education.

• Making the changes needed to achieve this vision will be challenging, requiring a significant investment of time and resources.

• Change, however, does not guarantee improvement, and improvement is imperative to meet the challenges facing mathematics teacher preparation.
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Improvement Must Be Rooted in Our Values

See the assumptions, in particular:

Those involved in preparing teachers of mathematics cannot hope to make substantial improvement toward the vision of this document without placing issues of equity, diversity, and social justice front and center.
Improvement Requires
Engagement of Multiple Constituencies

1. Collaboration among mathematics educators, mathematicians and statisticians
2. Close, respectful, bidirectional relationships with Pre-K–12 schools and districts
3. A focus on the Standards by the research community
4. Collaborations across programs
5. Support by higher education administrators
6. Focused work related to the Standards by AMTE
7. Engagement with other organizations

AMTE
ASSOCIATION OF MATHEMATICS TEACHER EDUCATORS

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Discussion