CENTER FOR SCIENCE AND MATHEMATICS EDUCATION

California Math Teacher Preparation and the Common Core

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1. The Standards Have Come To Us
2. Changes in CA Teacher Curriculum
3. A Sample Task
4. Discussion
5. Thanks

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The Standards Have Come To Us

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Elementary and Secondary Math Teacher Deep Curriculum

- Math can make sense.
- Math can convince others.
- Math is about inventiveness and exploration, as well as precision.
  - convergent AND divergent thinking
- Math facts can be deduced, not just recalled.
- Math algorithms can/should be explained.
- Know the feeling of math making sense and not making sense.
  - (So you know when to get help.)

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Elementary and Secondary Math Teacher Deep Curriculum

- Team problem solving
- Non-routine problems
- Representations: symbolic, physical, visual, numerical, verbal
- Non-standard algorithms
- Whole class argumentation

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Alignment with Old Standards

- Old CA Standards Strands
  - Number Sense
  - Algebra and Functions
  - Measurement and Geometry
  - Statistics, Data Analysis, and Probability
  - **Mathematical Reasoning** (a chapter!)
    - e.g. MR7.1.0. 'Students make decisions about how to approach problems'

- Common Core Standards
  - Standards for Mathematical Practice, better aligned!

(Practices) Standards Have Come To Us

- Make sense of problems and **persevere in solving them**.
- **Use appropriate tools strategically.**
- Reason abstractly and quantitatively.
- **Construct viable arguments** and **critique the reasoning of others**.
- **Model with mathematics**.
- Attend to precision.
- Look for and make use of structure.
- Look for and express regularity in repeated reasoning.

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(Practices) Standards Have Come To Us

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- **Non-routine problems**
- **Non-standard algorithms**
- **Team problem solving**
- **Group and whole class argumentation**
- **Representations and Models**
  - symbolic, physical, visual, numerical, verbal

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Changes to Teacher Curriculum

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Elementary Teacher Coursework (pre-NCLB)

Waiver Program

- **Math 165 : Number System**
- **Math 565 : Geometry, Measurement, and Prob**

Encouraged

- **Math 265: Advanced Number Systems (%, Z)**

Delightful Bonus

- **Math 575, 576, 577, 578: MS & HS Math**

Credential Program

- **EED 784: Math Curriculum & Instruction**

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Elementary Teacher Coursework (post-NCLB)

~~*Waiver Program*~~ ***Delightful Bonus***

- **Math 165 : Number System**
- **Math 565 : Geometry, Measurement, and Prob**

~~*Encouraged*~~ ***Not Offered***

- **Math 265: Advanced Number Systems (%, Z)**

~~*Delightful Bonus*~~ ***Unicorn-like Rarity***

- **Math 575, 576, 577, 578: MS & HS Math**

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Common Core Changes in the Elementary Math Curriculum

- Practices Anxiety — well covered
- Number line representation of numbers
- Part-Whole and Unit Fractions as foundational
  - (5/6 as 5 one-sixths)
- Proportional Reasoning
  - One quantity is a constant multiple of another.
  - Ratios, proportions, rate, percent, scale, slope, geometric similarity, probability…
- (and the reasoning and modeling practices, etc.)

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Secondary Math Teacher Coursework

In CA, a Full Math Major (Waiver Program)

MATH 226: Calculus I	MATH 300: History of Mathematics
MATH 227: Calculus II	MATH 309: Computation in Mathematics
MATH 228: Calculus III	MATH 310: Elementary Number Theory
MATH 301: Proof	MATH 324: Probability and Statistics
MATH 325: Linear Algebra	MATH 350: Geometry
MATH 335: Modern Algebra	**MATH 375: Early Field Experience**
MATH 370: Real Analysis I	**MATH 475: Capstone Course**
plus in credential program…	
SED 759: Math Curriculum & Instruction	**SED 769: Math Curriculum & Instruction**

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Teacher Fellows:
Professional Community & Service Learning

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Teacher Fellows (2008-2013)

70+
2013 Fellows

158
Total Fellows

17,000 hrs
total community service

25+ **schools served**

15 **school districts served**

$382,000
stipends from university, Federal, private donations

+

$285,000
outside awards

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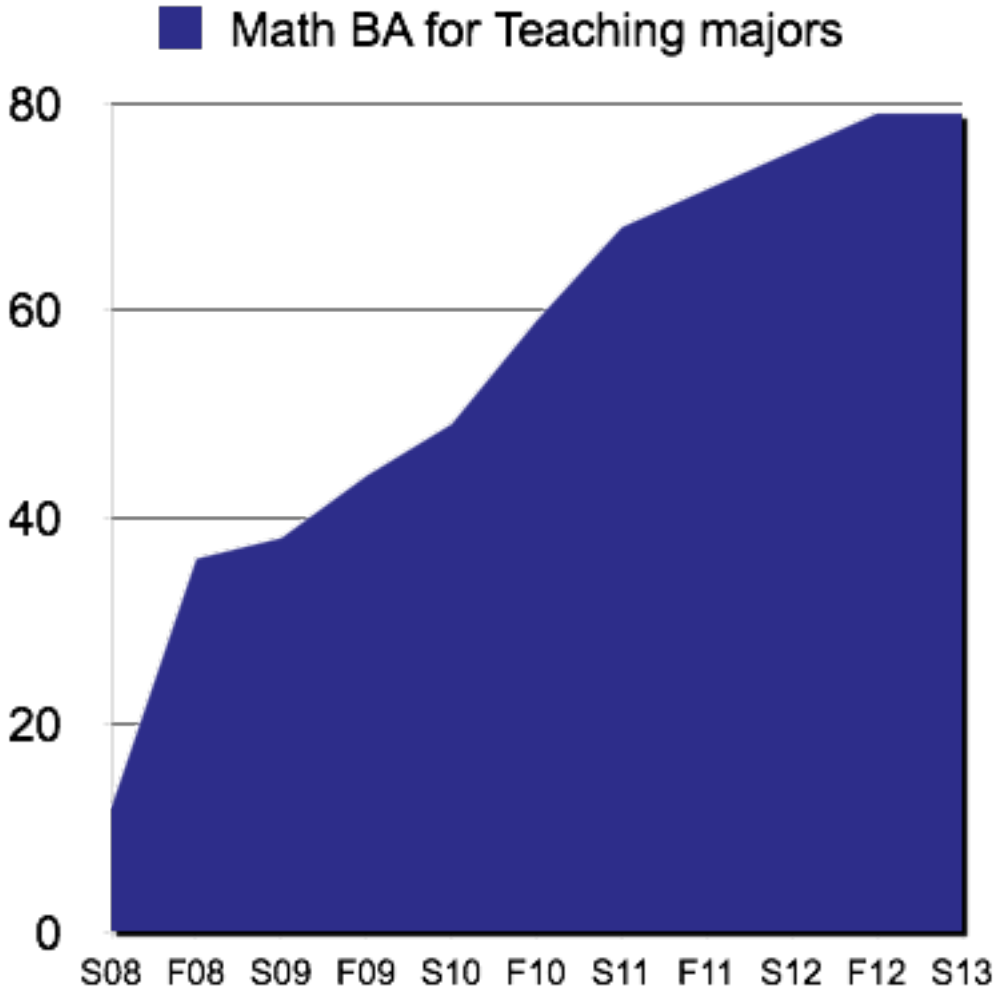
Triple the Math Teaching Majors



"A model for the state and nation. An outstanding program to be adopted by other campuses, that warrants scale up system-wide."

– CSU Chancellor's Office

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Secondary Math Teacher Coursework

A Full Math Major (Waiver Program)

MATH 226: Calculus I	MATH 300: History of Mathematics
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MATH 325: Linear Algebra	MATH 350: Geometry
MATH 335: Modern Algebra	**MATH 375: Early Field Experience**
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plus in credential program…	
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- *Added*
  - **Modeling,** proportional reasoning
  - More probability, expected value
  - More stats: p-values, confidence intervals…
  - Transformational Geometry
- *Removed*
  - History of Mathematics
  - Cross Products
  - non-Euclidean Geometry
- *Subtle Changes*
  - **'Know' to 'Demonstrate knowledge of'**
  - **'Know and apply' to 'Apply', 'Justify Steps'**

from CCTC Official Subject Matter Requirement Changes

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Standards on Paper vs. Standards in Life

- Integrated Courses
  - in theory, a need for powerful inter-connections between algebra and geometry

- Smarter Balanced Assessments
  - who knows?
  - Computers, free response, non-routine problems
  - High stakes warp the curriculum

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A Sample Task

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The Difference of Squares

Some numbers can be expressed as the difference of two squares. For example:

$8 = 3^2 - 1^2$

Sometimes there are several ways to do this:

$15 = 8^2 - 7^2$ or $15 = 4^2 - 1^2$

Investigate. Can any whole number N be written as the difference of two squares?

You might try 43, 99, or 60 as a difference of two squares? How about 26?

Generalize and justify your generalizations.

A Problem Protocol (Curriculum & Instruction)

- Restate the essence of the problem.
- Describe your thinking and reasoning as you worked on the problem and clearly show your solution process.
- Justify your solution (or progress so far with the problem).
- Reflect on the strategies you used. What did you learn?
- What mathematics would students practice or learn?

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Discussion

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Thanks to NSF

CAREER & MSP

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