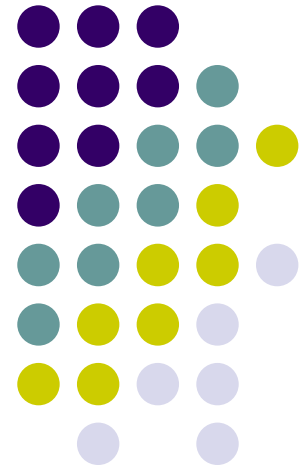


The New Regulation: Planning vs Implementation

Presented to STEM Summit IV
Sturbridge Host Hotel
October 17, 2007

by Stan Dick
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Elementary Candidates & Math Requirements @ UMass Boston



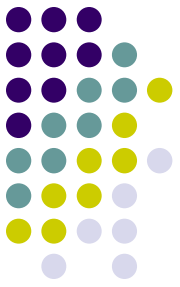
Numbers of Candidates

- About 15 Undergraduate Candidates per year
- About 50 Graduate Candidates per year

Current Math Requirements:

- Undergraduates: 1 Content/Methods Course
- Graduates: $\frac{1}{2}$ Content/Methods Course + Additional Course available as Elective

Planning for the New Regulation



- Attended Several Meetings @ Worcester State College to Understand and Plan for New Regulations
- As Member of GCE w/ Strong Math Background, I Welcomed new Regulation
- Worked with Steve Jackson of Math Dept over Summer to Plan Courses and Strategies for Readyng our Students for new MTEL

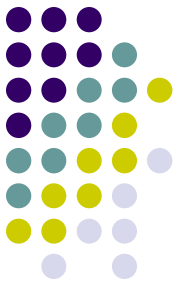
Yikes!

We Had Better Get Started



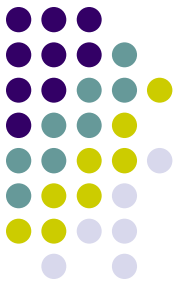
- Decided Students Need Three Math Courses To Pass New MTEL
- My Current course could be 1st Course
- First MTEL Will be January 2009
- ⑧ Students Must Start 3-Course Math Sequence This Fall

Where Should We House the Courses, GCE or Math Dept?



- Currently we have a Strong Math Person in Grad College of Ed, and
 - Person in Math Dept who Understands Elementary Math Education
- . . . But that may not be true in the future

So, Both! We Plan To Cross List the Courses



Put Courses Through Governance
Simultaneously:

- In Math Dept of College of Science & Math
- In Curriculum & Instruction Dept of Grad College of Ed

To Do List



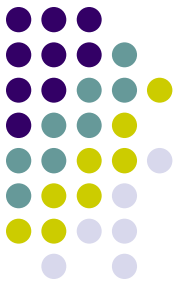
- New Rubric in the Math Department
- Three New Courses
- Cross Listing in Math Dept. & GCE
- Cross Listing in Undergrad & Graduate Programs
- For Undergrad Program: Get Quantitative Reasoning Distribution for 3rd Course
- Make Room for 1 Course in Undergrad and 2-3 in Graduate Program

But All This Happened this Summer while we were acquiring:



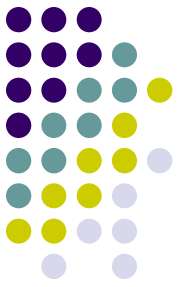
- a New Dean in the College Science & Math,
- a New Dean in the Graduate College of Education, and
- a New Chair in Curriculum & Instruction

Implementation: Sohowzitgoin?

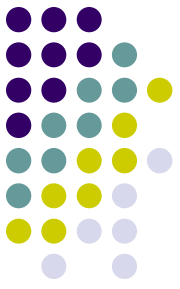


- Much too Slowly
- Making Room for New Courses is the biggest glitch

Initial Discussions with New Administration:



- *Any* Changes in the Teacher Education Programs must be part of a Comprehensive Revamping of the Programs
- . . . Graduate Program First, with the undergraduate program based on the graduate program
- “In the meantime, perhaps College Algebra-type courses will suffice.”



My Position:

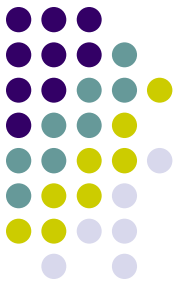
- I teach four math education courses a year to elementary teacher candidates
- All my courses are Content & Methods courses
- I am in favor of elevating the level of mathematics in this country
- Like DOE, I believe that an important element in that process is raising the level of elementary education

Nature of Needed Courses



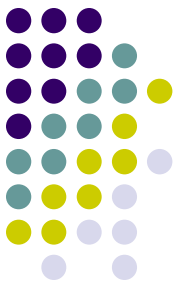
- Very Specialized Courses are Needed,
- . . . and very special teachers

Elementary Math is *not* Elementary



Three Kinds of Math Knowledge are Needed by Elementary School Teachers –

1. Content Knowledge,
2. Specialized Content Knowledge, and
3. Pedagogical Content Knowledge



Calculating $3\frac{1}{4} \div \frac{1}{2}$

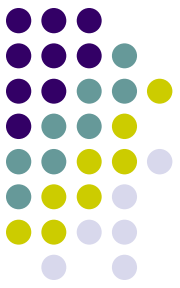
- Content Knowledge: $3\frac{1}{4} \div \frac{1}{2} = 6\frac{1}{2}$
- Specialized Content Knowledge: There are two fundamental models of division –
quotative (including repeated subtraction)
partative (one for me, one for Mary, one for Joe, one for me, . . .)
- Pedagogical Content Knowledge: Division above is based on Repeated Subtraction

Specialized Content is Only One reason specialized courses are needed



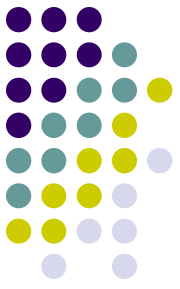
. . . the other is that elementary school teachers have little confidence in their ability in mathematics,
and may not fare well if put in courses with other B.A. students.

I need help in my negotiations with my colleagues



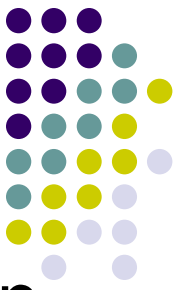
- Better Understanding of New Regulation
- Will Regulation Test Specialized Content knowledge, Pedagogical Content Knowledge?
- How and when will established programs be evaluated for the 9 credit requirement?
- A Sample MTEL or a Proxy (Math Placement Exam?) to gauge Student capability.

But there is last-minute hope:

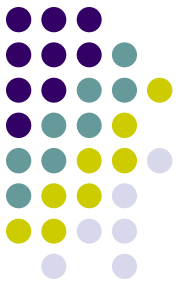


- An impassioned and strong plea on my part may be getting results.
- Just Monday, my chair has initiated fast-track discussions about possible changes to our teacher programs. :o)

Format for My Courses



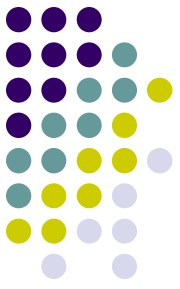
- In all my teacher courses I have students, in alternating groups, present the homework as soon as they come into class
- Presenting Group must answer questions from class members and instructor
- Surprisingly students find this less intimidating than a written exam
- This practice puts the students in charge from the beginning and sets a good tone for the class



Innovation in Format

- We plan to have an Assistant in Every Class - assistant goes around helping students during the period
- A \$50 Laboratory Fee per student pays for the Assistant
- This was pioneered in the Quantitative Reasoning Course

Decided to Develop all Three Courses from Scratch

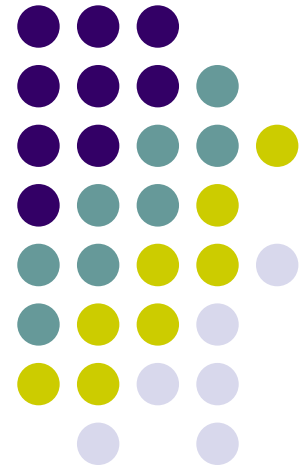


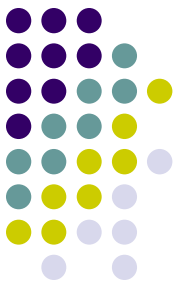
- Rather than have, say, a Number Sense Course, an Algebra Course, and a Geometry and Misc. Course, we opted to design our courses from scratch.
- This in itself is an interesting endeavor

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Outline of Three Courses

1st Course: Development of Number Systems
Through Rationals & Number Theory

1. Introduction

a) Difficulty of Elementary Math

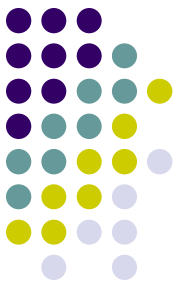
b) Discussion of Liping Ma Study

c) Discussion of Procedural vs. Constructivist
Curricula

d) NCTM & Massachusetts DOE Standards

2. Natural, Whole and Integer Number Systems

- a) The Number Line and Cuisenaire Rods**
- b) Set Concepts of Addition & Subtraction**
- c) Properties of Addition**
- d) Concepts & Models of Subtraction**
- e) Concepts & Models of Multiplication**
- f) Properties of Multiplication**
- g) Concepts of Division**
- h) Negative Numbers and the Integers**
- i) The Extended Number Line and Plus & Minus Cards**
- j) Operations with Integers**
- k) Derivation of Standard Arithmetic Algorithms**



3. Rational Number System

a) Need for & Meaning of Fractions

b) Using Egg Crates & Pattern Blocks for Teaching Rational Numbers

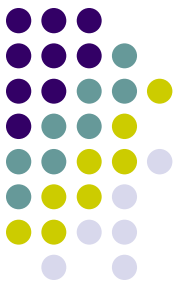
Numbers

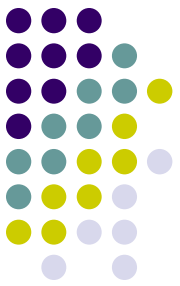
c) Equivalence of Fractions

d) Addition & Subtraction of Fractions

e) Multiplication & Division of Fractions

f) Rational Numbers & Equivalence Classes





4. Number Theory

a) Divisibility, Factors, Primes and Composite Numbers

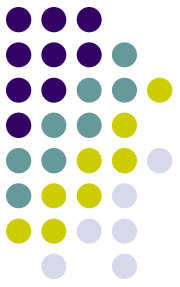
b) Division Algorithm, Greatest Common Divisor and Least Common Multiple

c) Euclidean Algorithm

d) Positive Integer Exponents

e) The Prime Factorization Theorem and Applications e.g. Finding gcd, lcm, and Number of Factors of a Number

2nd Course: Real Numbers, Decimal Representation, Functions & Algebra Part I



5. Mixed Numbers

6. Exponents

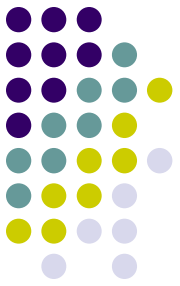
**7. Decimal Representation of
Integers and Rational Numbers**

8. Standard Arithmetic Algorithms

9. Functions, & Algebra Part I

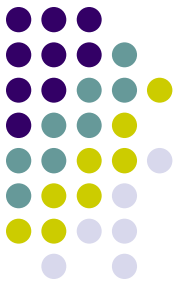
**10. Calculator Skills, Technology,
& Discrete Math**

3rd Course: Algebra Part II, Geometry, and Probability & Statistics



- 11. Algebra Part II**
- 12. Problem Solving**
- 13. Geometry**
- 14. Probability**
- 15. Statistics**
- 16. Permutations and
Combinations**

That's All Folks!



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