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Preparing Elementary School Mathematics Teachers and Leaders *Issues to Consider*

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National Council of Teachers of Mathematics
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Areas we will examine:

- Mathematics Content – teachers and specialists/leaders
- Mathematics Education/Pedagogy
- Field Experiences
- Leadership – the missing variable re: specialists
- Certification and Accreditation Issues
- Goals
  - Thinking about what's similar and different, and is that OK?
  - Determining what's needed.

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Policy initiatives which shape…

- Principles and Standards for School Mathematics (NCTM, 2000)

- Mathematical Education of Teachers (CBMS, 2001)

- Adding it Up (NRC, 2001)

- Foundations for Success – Report of the National Mathematics Advisory Panel (US Dept of Education, 2008)

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Knowing the Mathematics for Teaching

- Knowing mathematics for teaching (MKT) 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

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Considering…relationships

Mathematics and Education Department, Schools, and Colleges

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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

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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.

- ***Recommendation 2.*** Although the quality is more important than the quantity, the following mathematics coursework for prospective teachers is recommended.

  - Number and Operations
  - Algebra and Functions
  - Geometry and Measurement
  - Data analysis and Probability

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Impact of MET

- Used for NCTM's NCATE Standards for Elementary School Specialists
- 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 Advisory Panel Report

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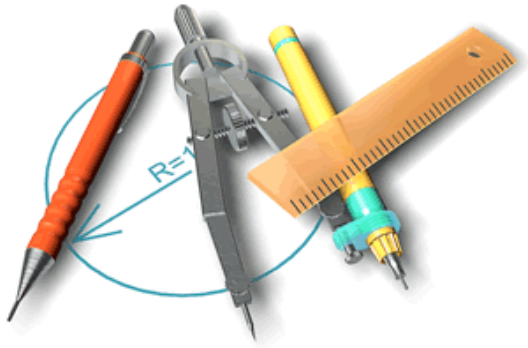
What Mathematics



- Number and Operations
- Algebra
- Geometry
- Data Analysis and Probability

YOUR TURN

- Other?
- How is this distributed at your institution?
- How many courses? Credits? What about Community College transfers?

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Pedagogy and Field Experiences

- Pedagogy/Instruction
  - Methods course preservice – more?
  - Mathematics education coursework – specialist programs
- Field Experiences
  - How many?
  - Location? Length?
  - Internships?

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Accreditation & Certification

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Accreditation - NCATE

- National Council for Accreditation of Teacher Education
- NCATE currently accredits **632 colleges of education** with nearly 100 more seeking NCATE accreditation.

NCATE
The Standard of Excellence in Teacher Preparation

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ACEI/NCATE Standards - Elementary

NCATE
The Standard of Excellence in Teacher Preparation

- 2d. Mathematics – Candidates know, understand, and use the major concepts, procedures, and reasoning processes of mathematics that define number systems and number sense, geometry, measurement, statistics and probability, and algebra in order to foster student understanding and use of patterns, quantities, and spatial relationships than can represent phenomena, solve problems, and manage data.

Curriculum component of the ACEI Standards

ACEI Standards - Elementary

NCATE
The Standard of Excellence in Teacher Preparation

Elements of Standard

- Know and understand
  - Number systems and number sense (Knowledge, Skills)
  - Geometry (K,S)
  - Measurement (K,S)
  - Statistics (data analysis) and probability (K,S)
  - Algebra (K,S)
- Use major concepts, procedures, and reasoning processes to foster K-6 student learning (Impact)

Rated: Unacceptable – Acceptable - Target

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ACEI Standards - Elementary

NCATE
The Standard of Excellence in Teacher Preparation

Elements of Standard

- Know and understand measurement
  - Attributes: K, S
  - Ratings: Unacceptable, Acceptable, Target
- Know and understand geometry
  - Attributes: K, S
  - Ratings: Unacceptable, Acceptable, Target
- Know and understand statistics (data analysis) and probability
  - Attributes: K, S
  - Ratings: Unacceptable, Acceptable, Target

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NCATE/NCTM

- Mathematics Preparation for All Mathematics Teacher Candidates
  1. Problem Solving
  2. Reasoning and Proof
  3. Communication
  4. Connections
  5. Representation
  6. Technology
  7. Dispositions
  8. Mathematics Pedagogy

NCATE
The Standard of Excellence in Teacher Preparation

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NCATE (cont.)

NCATE
The Standard of Excellence in Teacher Preparation

- Mathematics…for **Elementary Specialists**
  9. Number and Operations
  10. Algebra
  11. Geometries
  12. Data Analysis, Statistics, and Probability
  13. Measurement

  14.1 Field-Based Experiences – internships

  14.2 Field-Based Experiences – full-time

  14.3 Field Based Experiences – increase student knowledge

Only 9 institutions have this accreditation

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and they are…

- Concordia University, IL (K-4)
- Eastern Illinois University (K-4)
- Elmhurst College, IL (K-4)
- Southern Illinois University (K-4)
- North Carolina Central University (1-4)
- Concordia College, NY (K-6)
- SUNY-Oswego, NY (K-6 and K-9)
- Texas A & M University (K-4)
- Southern Utah University (K-8)

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NCATE and Elementary Specialists

- Six assessments required – many institutions would do all eight
  1. **Content Knowledge** – Data from licensure tests
  2. **Content Knowledge** – Assessment of content knowledge in mathematics
  3. **Pedagogical and Professional Knowledge** – Planning instruction
  4. **Pedagogical and Professional Knowledge** – Candidate knowledge and skills applied in practice
  5. **Effects on Student Learning** – Demonstrates candidate effect on student learning.
  6. **Additional Assessment** – case study, portfolio, etc.
  7. **Optional** – Additional Assessment
  8. **Optional** – Additional Assessment

NCATE
The Standard of Excellence in Teacher Preparation

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Accreditation - TEAC

- Teacher Education Accreditation Council

Listing 76 accredited member institutions. Relatively new, 10th annual meeting yesterday.

Some institutions involved are:

Michigan State University
University of Missouri
University of Richmond
Rutgers, the State University of New Jersey
University of Michigan
University of Virginia
Colgate
…

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Alternative Certification Options

- Traditional Programs delivered in "alternative" format

&

- ABCTE

AMERICAN BOARD for Certification of Teacher Excellence

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

University of Phoenix
America's largest accredited private university.

MfA Math for America

TEACHFORAMERICA

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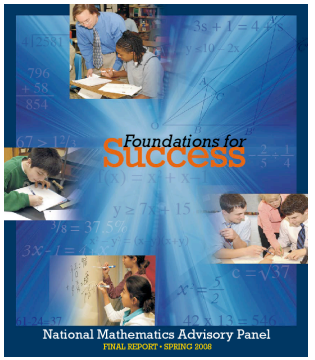
Teachers and Teacher Education

Mathematically Knowledgeable Classroom Teachers Have a Central Role in Mathematics Education.

- Research indicates that differences in teachers' knowledge and effectiveness between pathways into teaching are small or non-significant compared to very large differences among the performance of teachers within each pathway.



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OK, YOUR TURN

Value of accreditation?

Is there a way to fix this?

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Mathematics Specialists

Elementary Mathematics Teacher Specialist

Elementary Mathematics Specialist

Elementary Mathematics Coach

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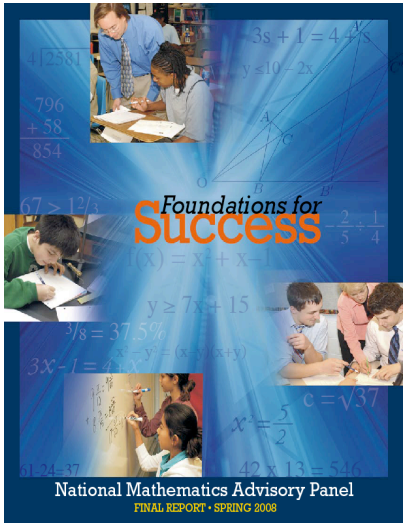
- The Panel recommends that research be conducted on the use of full-time mathematics teachers in elementary schools – elementary mathematics specialist teachers.



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Mathematics Content

- Knowledge of Number and Operations
- Knowledge of Different Perspectives on Algebra
- Knowledge of Geometry
- Knowledge of Data Analysis, Statistics and Probability
- Knowledge of Measurement

- **How is this different from preservice? Does it need to be?**
- **Take a look…**

Virginia Specialist Certification

- 3-years of teaching
- Content
  - Number systems and number theory
  - Functions and algebra
  - Geometry and Measurement
  - Statistics and Probability
- More…
  - History of mathematics
  - Curriculum studies and trends
  - Role of technology
  - Instructional materials and resources
  - Assessment and diagnosis
  - Diverse learners
  - Learner and leadership issues
  - Understanding of and proficiency in grammar, usage, and mechanics and their integration in writing.

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University of Georgia

- Math Endorsement – Preservice and Inservice
- Content
  - Arithmetic and Problem Solving (u/g)
  - Geometry and Problem Solving (u/g)
  - Algebra and Problem Solving (u/g)
- Pedagogical Content Knowledge
  - Children's Mathematical Thinking (u)
  - Mathematics Curriculum for PreK-5th Grade (u)
  - Mathematics Learning in PreK-Grade 5 (g)
  - Mathematics Methods for Early Childhood Education (g)

AND

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University of Georgia

- 2 courses, part of masters and specialist programs for preK-5 and 4-8 teachers.
  - Course on mentoring (3)
  - Mentoring project internship (3) 30 hours of mentoring activity

Ohio's P-6 Mathematics Specialist

Program Components

- Mathematical Content Knowledge and Knowledge of Curriculum
  - Content and Process Standards
  - Use Standards to Evaluate Math Curricula
- Knowing Students as Learners of Mathematics
- Instructional Strategies and the Use of Materials and technology
- Assessment, Diagnosis, and Evaluation
- Research for the Teaching and Learning of Mathematics
- Professional Development

Statewide endorsement, post baccalaureate, three years of teaching – Brad Findell,

University of Arizona

Curriculum – Required minimum of 33 units of graduate courses

College Core (3 units):
Introduction to Educational Research

Major Core (6 units):
Recent Research on Teaching and Schooling
Curriculum Theory and Policy

Supporting Coursework (24 units)
a. The following TTE mathematics education courses are required (9 units):
The School Curriculum: Mathematics
Curriculum Issues and Practices: Mathematics
Math Diagnosis and Remediation

b. Three of the following 3-unit courses offered by the Mathematics Department are required (9 units):
MATH 500 - History of Mathematics for Elementary School
MATH 501 - Arithmetic and Number Theory through Problem Solving
MATH 506 - Geometry for Elementary School
MATH 510 - Algebra for Elementary School Functions
MATH 560 - Probability and Statistics for Elementary School through Activities and Games

c. Electives: 6 additional graduate credits to be approved in advance by an assigned advisor.

Supervised Field Experience (6 units)
TTE 593
Internship (6 units)
Required of students who do not have at least 2 years of teaching experience by the completion of the MA degree. These units are beyond the minimal 33 required units.

Thesis Option (4 units)

Portfolio
The student begins a portfolio before completing the 12th graduate unit and maintains it throughout the degree program. A 2-person committee supervises the portfolio.

Exit Requirement
Oral Defense of Thesis - The oral defense of the master's thesis constitutes the exit requirement for those students who take this thesis option.

Comprehensive Examination - All students not completing the thesis option must take a comprehensive examination. The master's examination has two parts :
Part I consists of four questions, two related to each of the major core courses. Students are required to respond to one question related to each course.
Part II consists of responding to two of four questions that test the content of the six mathematics and mathematics education courses.

Masters Degree Program

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- Mathematics (12)
  - Number
  - Algebra
  - Geometry and Measurement
  - Data Analysis and Probability
- Education (6)
  - Educational Research
  - Supervision

- Mathematics Education (13)
  - Teaching Elementary School Mathematics
  - Intervention and Diagnosis in Mathematics
  - Trends and Issues
  - Math Leadership Internship
  - Thesis

Home Project Programs Resources Certification Research Contacts

Elementary Mathematics Specialists and Teacher Leaders Project

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We need elementary school mathematics specialists, elementary classroom teachers who know and understand mathematics and can effectively

About the Project

www2.mcdaniel.edu/emstl

The major goals of the McDaniel College EMS&TL Project are to fully establish a graduate program leading to an MS degree in elementary mathematics teacher leadership, to develop a clearinghouse relative to elementary mathematics specialist programs nationally, and to ensure the continuing professional development and mentoring of a cadre of mathematics teacher-leaders and elementary school mathematics specialists in Maryland. Additionally, the project seeks to determine the impact of mathematics specialists and mathematics teacher specialists on student achievement and school and school district improvement regionally, statewide, and potentially, nationally.

This is a proposed multi-year project, with the formal establishment of the

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University of Michigan – Modules - MKT and Pedagogy
McDaniel College – Modules - Leadership Issues

More to come – next year!

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What do specialists do?

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What might an elementary mathematics specialist do?

- Work one-on-one with a variety of students
- Teach demonstration lessons
- Interact with parents about mathematical tasks, topics, or approaches
- Participate in school improvement projects
- Facilitate professional development
- Advise in the selection of curriculum materials
- Analyze results from high stakes achievement tests
- Assist in the development reporting systems

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Think about…

- Being a good teacher of children does not make one a good teacher of peers/administrators/parents, etc.
- There are unique skills and processes involved in being a leader.

Denise Mewborn, 2008

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Leadership Issues…

- Developing expertise
  - The importance of leader content and pedagogical background.
  - What to look for – mentoring teachers and considering content and pedagogy.
- Working with the larger community
  - Working with parents
  - Policy makers and their role and impact policy
  - Mathematics leaders and the media
- Budget issues for mathematics specialists and leaders
- Working with other colleagues (including reluctant ones!)
- Working with administrators
- Change
  - How do you know when you are ready for it?
  - How do you know when you are there?

Fennell, 2008

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Leadership for Specialists

- "Go-to" people for math-related things
  - Building/district committees
  - Textbook adoption
  - Redeploy professional development
  - Ordering and organizing manipulatives
  - Parents
  - ELL, gifted, special education…

Denise Mewborn, 2008

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Knowledge/experience needed

- Models of coaching–e.g., content-focused coaching, differentiated coaching
- Adult learning
- Conflict resolution, negotiation
- Collaboration strategies

Denise Mewborn, 2008

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OK, YOUR TURN

- What about pedagogy?
  - How much?
  - How is it different in a specialist program?
- What about field experiences?
  - Preservice – frequency, length, use of PDS
  - Specialist Programs - Needed? How to organize?
- Is there a need for accreditation here?
- Who's in charge? (Ohio…)

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From the field…

One State - Maryland

- Elem Specialists (school based, non-teaching – 366.5
- Elem Specialists (school based, intervention) – 83
- Overall – 653.5 (includes middle and high school; 24 county school districts)

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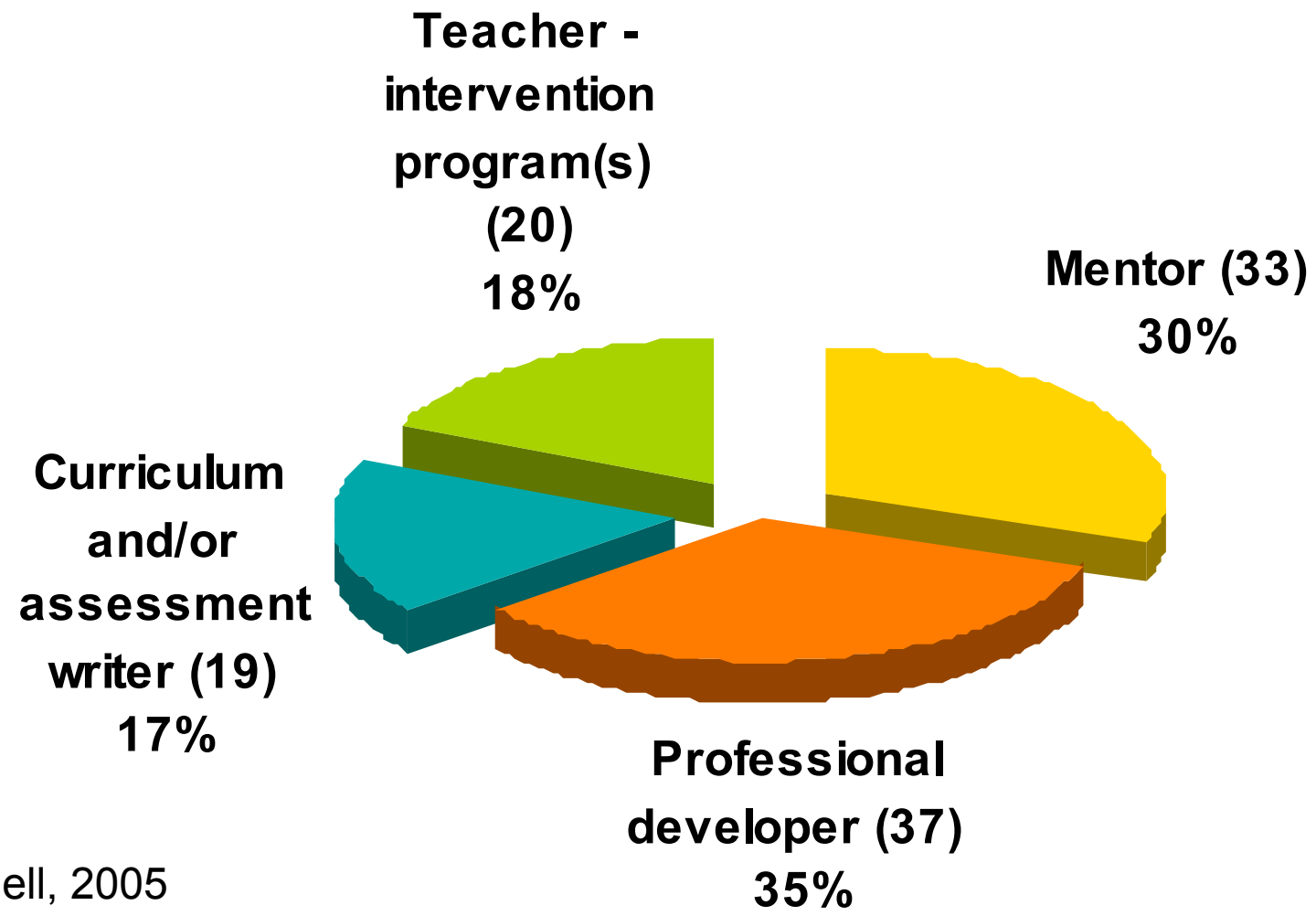
Roles of Mathematics Specialists/Leaders



Fennell, 2005

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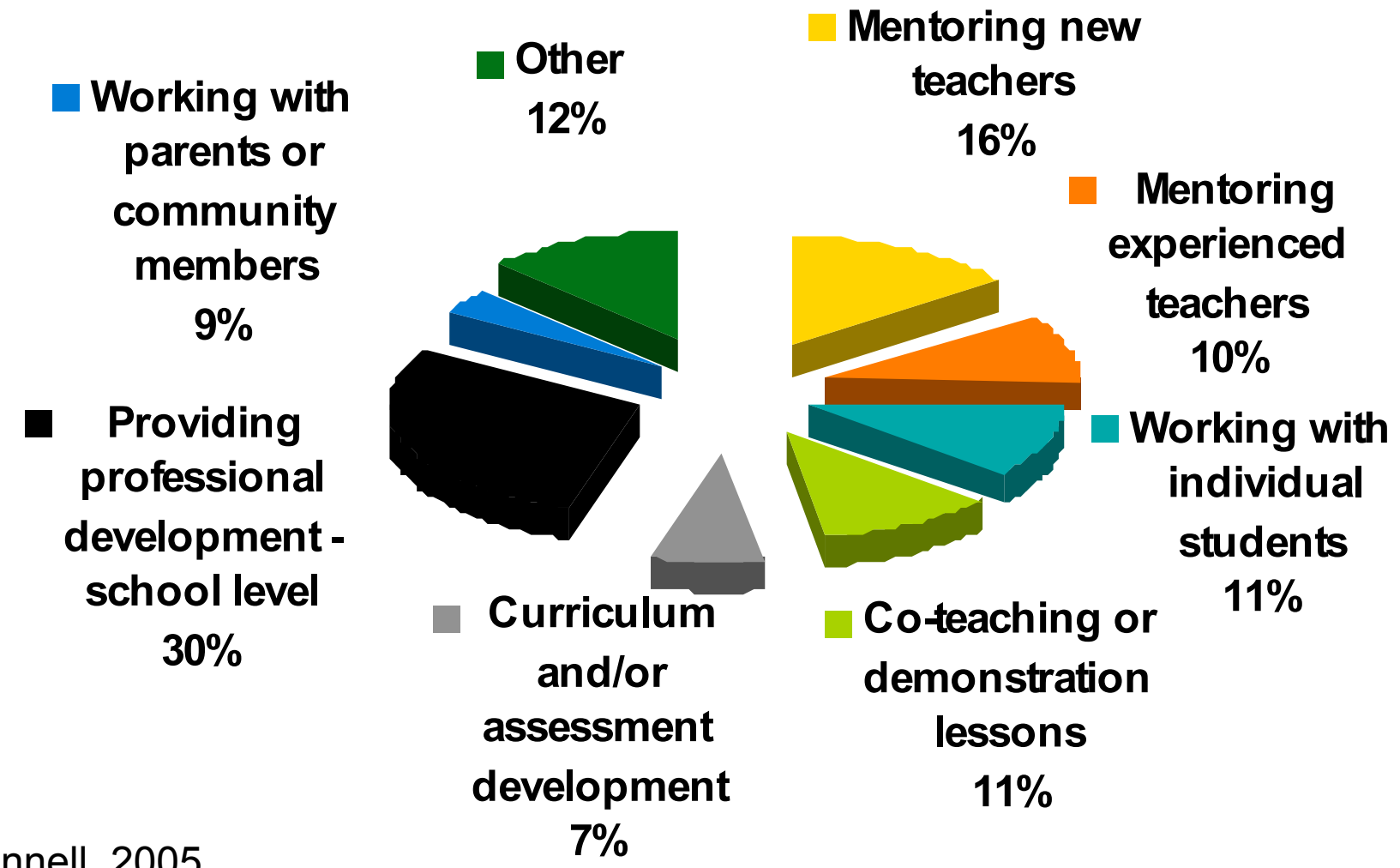
Other Roles of Specialists/Leaders

- Score assessments
- Chair schoolwide mathematics committee
- Coach
- Create and implement Monthly Math Challenges
- Data analyst
- Develop and share instructional materials/resources
- Informal teacher observations
- Maintain schoolwide database
- Oversee before/after school tutoring program
- Plan and implement Family Math Programs
- Professional development courses/workshops for administrators, teachers, instructional assistants at school/county levels
- Teach demonstration lessons

How Time is Spent…



Fennell, 2005

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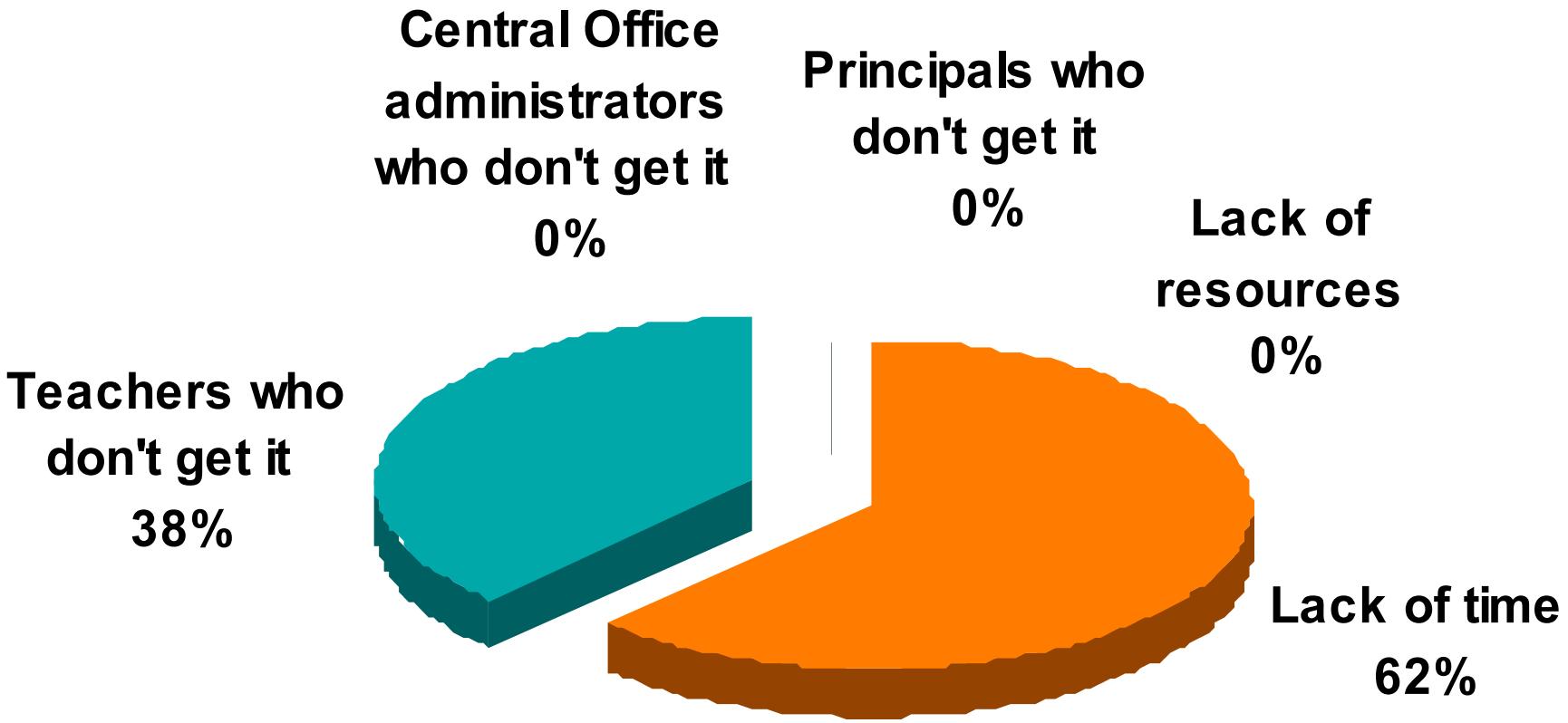
Day-to-Day Frustrations



Fennell, 2005

Greatest Challenges

Fennell, 2005

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If you could change your position as an elementary mathematics specialist leader in ONE way, what would you do?

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- **Find ways to foster learning communities within my schools (HC, WC)**
- I need a little more support in order to enforce certain practices that are not being done in mathematics classrooms (HC).
- **The teachers that need us the most are the most reluctant to work with us (HC).**
- I would have a primary specialist and intermediate specialist within the school. The needs are very different (HC).
- **I would add a teaching component to my role – daily (WC).**
- Too much of my time is “staff development on the run” (WC).
- **Clearly defined job description – share with staff and principal (WC).**

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YOUR TURN

- How are the content, pedagogical, and field-based components of preservice and elementary mathematics specialist programs similar? Different?
- What is/should be the pedagogy and/or policy coursework for elementary mathematics specialists?
- What can we do to support and sustain the work of elementary specialists and find out more about what works?
- **Proposal – Affiliate Group EMS&TL**

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http://ffennell.com

GOD PUT ME ON EARTH
TO ACCOMPLISH A
CERTAIN NUMBER OF
THINGS. RIGHT NOW
I AM SO FAR BEHIND,
I WILL NEVER DIE.