The Complexity of Early Mathematics Education

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In 1983, the Commission on Excellence in Education first reported U.S. students “lagging behind” other industrialized nations.
No Improvement Among U.S. 4th Graders

(NCES, 2003 TIMSS Highlights)
Inadequate Improvement Among U.S. 8th Graders

(NCES, 2003 TIMSS Highlights)
School Readiness and Later Achievement

Kindergarten entry

Early reading skills

Early math skills achievement

3rd to 8th grades

Later reading achievement

Later math

Early math skills

Later reading achievement

Duncan, et al. 2007
Myth 1:
Early mathematics education is primarily learning numbers and shapes.
National Council of Teachers of Mathematics (NCTM)

Content & Process Standards

Communication
Reasoning and Proof
Problem Solving
Representation
Connections
Sample of a Child’s Algebraic Thinking
Myth 2:

Teaching early mathematics is easy since it’s about the most basic math.
Early Mathematics Teaching

WHAT
Content Knowledge

WHO
Knowledge of Children

HOW
Instructional Methods

PCK
Pedagogical Content Knowledge

Shulman, 1986, 1987
Counting is Complex
Number is Complex
Myth 3:

Young children pick up mathematics concepts naturally through play and in their daily lives. Direct instruction is unnecessary and developmentally inappropriate.
Scientific concepts originate in classroom instruction, helping to transform the structure of the child’s spontaneous concepts and organize them into a system.

Spontaneous concepts originate in the child’s personal experience. They are often used as mediators to understand the scientific concepts.

Vygotsky, 1978
Good early mathematics should...

Enhance children’s *natural interest* in mathematics; and

*Build on* children’s varying experiences, including their family, linguistic, and cultural backgrounds.

---NAEYC/NCTM Joint Position Statement, 2002
Myth 4: Early mathematics learning happens through hands-on activities with manipulatives.
There is a significant relationship between the amount of math-related talk by preschool teachers and the growth of mathematics knowledge in their children over the school year.

Klibanoff, et al. 2007
Children do not learn by doing. They learn by *thinking* and *talking* about what they are doing.

--Angela Andrews
Our Challenge:
Most early childhood teachers are not adequately prepared to teach early mathematics.
Mathematics activities take place in only 21 percent of CPS early childhood classrooms on a given day

(Chicago Program Evaluation Project, 2007)
Teacher Preparedness

Percent of early childhood teacher education programs in New Jersey’s 4-year colleges that provide ...

A course focused on early literacy 80 %

A course focused on early mathematics 16 %

Mathematics only as part of integrated ece curriculum 74 %

No early mathematics training at all 10 %

Lobman, Ryan, & McLaughlin, 2005
The Early Mathematics Education (EME) Project

- Supported by McCormick Foundation and CME Trust
- Served 80 CPS preschool and kindergarten teachers and the 2,500 children they teach in 2007-2008
- Are serving an additional 86 teachers this year
Two Elements of EME

Workshop Sessions

On-Site Consultation
EME Combines Great Children’s Literature with Early Mathematics
Content Standards of the National Council of Teachers of Mathematics (2000)

BIG IDEAS

- Algebraic Thinking
- Geometry
- Number and Operations
- Data Analysis
- Measurement
Sessions are Interactive and Hands-On
Teachers Have Lots of Opportunities to Work Together
Early Mathematics Education in Perspective
THANK YOU

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