

# CURRICULUM SPACES: SUPPORTING TEACHERS' AMBITIOUS AND EQUITABLE USE OF CURRICULUM

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August 5, 2014

Presentation to CADRE DRK-12 Conference

# ACKNOWLEDGEMENTS

## National Science Foundation

- On the Teach Math grant (DRL #1228034/1020155):
  - Julia Aguirre, Tonya Bartell, Mary Foote, Amy Roth McDuffie, Erin Turner
- On the Constructing Coherence grant (DRL # 1158860/0643497):
  - Alejandro Andreotti, Tonia Land, Andrew Tyminski
- Teachers – Prospective and practicing

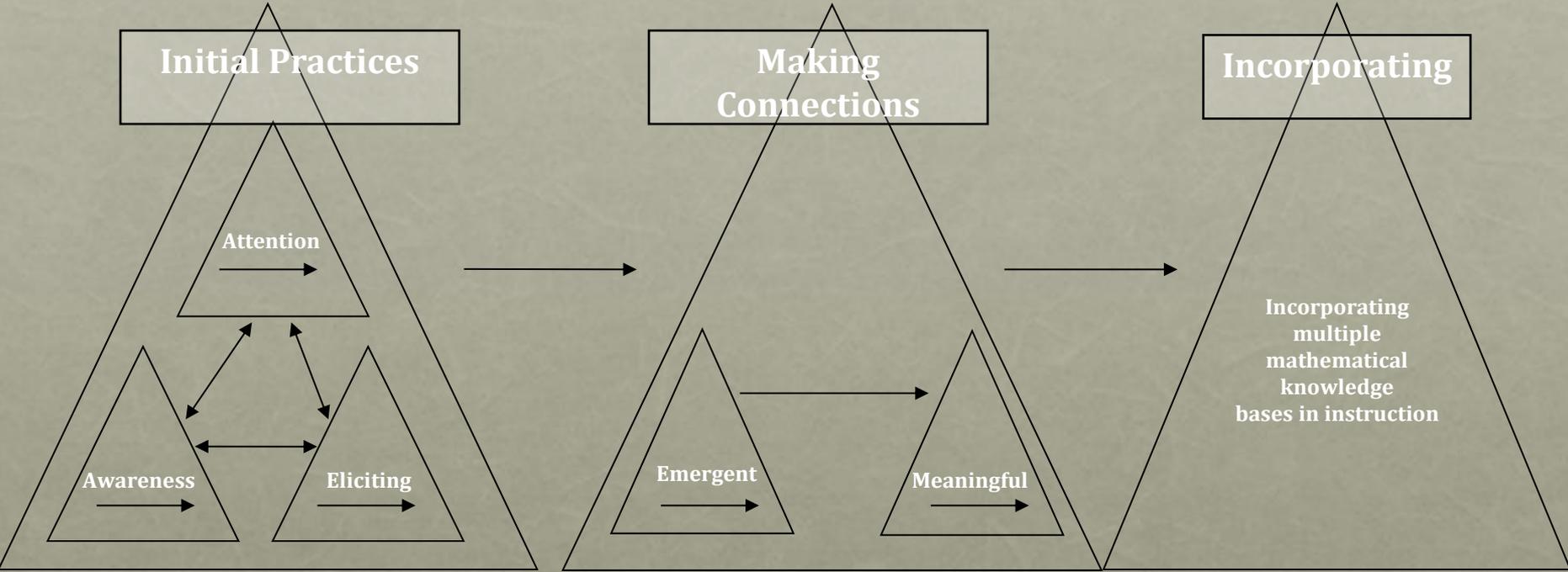
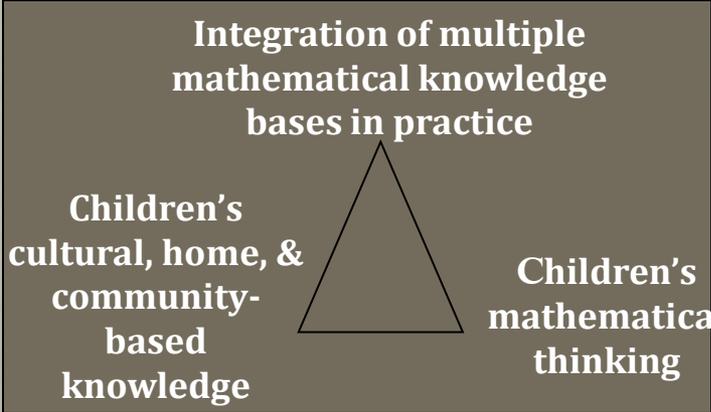
# OVERVIEW

- Project goals (Teach Math and Constructing Coherence)
- Rationale for focusing on teachers' curriculum use
- Tensions, challenges, and opportunities involved in opening curriculum spaces
- A design and research approach to addressing some of these tensions in elementary mathematics teacher preparation and in teacher education more broadly

# TEACH MATH

- Design, study, and refine instructional modules for preK-8 mathematics methods courses that explicitly develop prospective teachers' (PSTs') competencies related to mathematics, children's mathematical thinking and children's community/cultural/linguistic funds of knowledge.
  - Community Mathematics Exploration
  - Mathematics Learning Case Study
  - Critical Analysis of Mathematics Classroom Practices
    - Curriculum spaces
- Longitudinal study across five university sites – Understanding the role of contexts over time
  - Supports and constraints
- “It is not enough to prepare teachers with the dispositions to teach all students, or with knowledge of their students' cultural and linguistic resources. Teachers need to know how to use such knowledge in order to help students develop intellectual skills and to succeed academically.” (Grossman, McDonald, Hammerness & Ronfeldt, 2008, p. 244).

# PSTs' **Learning Trajectory** for engaging children's multiple mathematical knowledge bases



[For more on this trajectory, see Turner, Drake, Roth McDuffie, Aguirre, Bartell, & Foote, 2012 *JMTE*,]

# WHY CURRICULUM MATERIALS?

- Potential for large-scale impact (Ball and Cohen, 1996)
  - Ubiquitous and mandated in elementary mathematics
- Development of “educative” materials (Davis & Krajcik, 2005)
  - Development of curricular knowledge can support development of other important knowledge bases for teaching
  - Requires educative use
- Materials as representations/records not only of practice, but of research on mathematics teaching and learning
  - Not always explicit, but a way of bridging research/practice divide (Boaler, 2012)

# USE OF CURRICULUM MATERIALS

- Interactive, participatory relationship (Remillard, 2005)
- Consistent practices and strategies for using curriculum materials (e.g., read, evaluate adapt – Sherin & Drake, 2009)
- PSTs need scaffolds for reading, evaluating, and enacting curriculum materials in particular ways (Beyer & Davis, 2009; Drake & Land, 2011; Schwarz et al., 2008)
- Teachers’ life experiences and “math stories” provide lenses for making sense of curriculum materials (Drake, 2006)

“Expert Curriculum Use”:

- PDC (Brown, 2009) – “Perceive and mobilize”
- Curriculum vision and agency (Drake & Sherin, 2009; Drake, Cirillo & Herbel-Eisenmann, 2009)
- “Curriculum-proof teacher” (Taylor, 2013)

# TENSIONS

- Cannot fit everything into pre-service teacher education, but cannot rely on in-service teacher education
  - Need to identify accessible, generative practices for pre-service teacher education
- Definitions of “good” teachers in relation to curriculum use (Ball & Feiman-Nemser, 1988)
- Balance between using published/mandated curriculum materials and being responsive to children
  - Connected to a more fundamental challenge in teaching/teacher education today – Perceived lack of agency and increasing constraints
- Development of high-leverage practices typically disconnected from curriculum context
  - Forces novice teachers to choose or to do a great deal of interpretive, adaptive work

# CURRICULUM SPACES

- “...reforms that focus just on the design of curriculum materials...overestimate the capacity of curriculum materials to communicate and convey the means for accomplishing classroom innovations, and reforms that focus just on the development of teacher capacity...underestimate the capacity of curriculum materials to do the same.” (Brown, 2002, p. 26)
- Need to understand features that might be present across curriculum series
- Both the affordances and the constraints of curriculum materials assume particular ways of using and interacting with curriculum materials
- Policies, cultures, and genres of writing/reading that have been built around the use of curriculum materials
- Third space (Moje et al., 2004) – Both for students and teachers
- Focus on small changes (Morris and Hiebert, 2011) that support agency within constrained spaces

# AN EXAMPLE: *EDM*, GRADE 4

OBJECTIVE: “To guide the exploration of a variety of strategies to solve equal-grouping division number stories” (UCSMP, 2007, p. 406)

MATH MESSAGE: “A box holds 6 chocolate candies. How many boxes are needed to hold 134 chocolate candies?” (p. 407)

TEACHER DIRECTIONS:

- “Ask several students to give their solutions to the Math Message problem and to describe their strategies. [Information about “four possible strategies” is provided.]” (p. 407-408)
- “Tell students that there are many ways to solve equal-grouping division problems. One strategy, multiples-of-10, is introduced in this lesson” (p. 408)
- Extended scripting of explanation of multiples strategy, with examples (p. 408-410)
- “Encourage students to use a variety of strategies to solve the problems on journal pages 142 and 143” (p. 410)

# Student Page

Date \_\_\_\_\_

Time \_\_\_\_\_

LESSON  
**6-2**

## Solving Division Problems



For Problems 1–6, fill in the multiples-of-10 list if it is helpful. If you prefer to solve the division problems in another way, show your work.



1. Jose's class baked 64 cookies for the school bake sale. Students put 4 cookies in each bag. How many bags of 4 cookies did they make?

10 [4s] = 40

Number model:  $64 \div 4 = 16$

20 [4s] = 80

Answer: 16 bags

30 [4s] = 120

40 [4s] = 160

50 [4s] = 200

2. The community center bought 276 cans of soda for a picnic. How many 6-packs is that?

10 [6s] = 60

Number model:  $276 \div 6 = 46$

20 [6s] = 120

Answer: 46 6-packs

30 [6s] = 180

40 [6s] = 240

50 [6s] = 300

3. Each lunch table at Johnson Elementary School seats 5 people. How many tables are needed to seat 191 people?

10 [5s] = 50

Number model:  $191 \div 5 \rightarrow 38 \text{ R}1$

20 [5s] = 100

Answer: 39 tables

30 [5s] = 150

40 [5s] = 200

50 [5s] = 250

# OPENING SPACE IN THE *EDM* LESSON

- Omit explanation of the multiples strategy and/or the scaffolded worksheet that directs/requires students to use a single strategy
- Focus on one problem with multiple number choices:

Jose's class baked \_\_\_\_\_ cookies for the school bake sale. Students put \_\_\_\_\_ cookies in each bag. How many bags did they make?

(24, 4) (64, 4) (180, 6) (276, 6) (191, 5)

- Elicit and connect to authentic connections (may or may not include the context given in the published curriculum materials)

# ANALYSIS

- Analyzed 24 lessons – 3 each from 8 different elementary mathematics curriculum series
- Introduction to fractions, single-digit multiplication, and multi-digit addition
- Considering what we know about children's learning of mathematics, where were the spaces for connecting to (including eliciting, building on, etc.) children's MMKB?

# CODING SCHEME

- Spaces for real-world connections
  - Replace
  - Single space
  - Open space
  - Space with no mathematics
- Spaces for exploration/making sense
- Spaces for discussing/explaining

*Each of the above codes could occur before (B) or after (A) a solution strategy has been presented by the teacher and/or textbook and with or without teacher supports.*

# FINDINGS

- 96% of the lessons attempted to make real-world connections; however, the connections were rarely presented in ways that would help students use the connections to make sense of mathematics
  - Approximately 1/3 of lessons only “replaced”
  - Approximately 1/5 of lessons presented connections after strategies – “application”
  - Approximately 1/3 of lessons connected to contexts before strategies, but very few elicited contexts or connections from students
- Specific design features that open or close potential spaces for exploring and discussing
  - Timing and location of spaces in relation to textbook or teacher strategies
  - Supports for teachers
- Significant differences existed among the curriculum spaces in the main lesson and the lesson peripherals (e.g., teaching notes, differentiation activities, homework).

# IMPLICATIONS

- The promise of the construct of “educative” curriculum materials requires the use of those materials in educative ways
  - Perceiving and mobilizing spaces for connecting to children’s MMKB
  - Developing vision and agency to enact changes within these spaces
- Large-scale enactment of ambitious and equitable practices requires that they can be enacted within the broader practice of using curriculum materials
  - In this study, we identified spaces in which this integration might occur.
  - Identifying both the supports and constraints for these practices within curriculum materials
- Re-visiting the construct of “curricular knowledge” (Shulman, 1986) or curriculum capacity
  - Decisions across materials vs. decisions within materials

# NEXT STEPS

- Study and refine the scaffolding tools and examples
  - Empirical data re: PSTs' use of tool and identification of spaces
  - Connections between curriculum spaces and equitable teaching practices
  - Supporting school and district leaders in supporting teachers
- Choosing curriculum context(s)
  - Uncertain curricular contexts, in terms of nature and quality of materials
  - Curriculum-general or curriculum-specific strategies (Taylor, 2013)
  - Which strategies for using educative curriculum materials would also be useful for using materials not specifically designed to be educative?
- Curriculum design – Designing materials with more open spaces and more guidance for using in ambitious and equitable ways, including common language
- Consider the current/future directions of curriculum development
  - Digital turn
  - Open source
  - Common Core

- Questions?
- Comments.
- More Information:
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