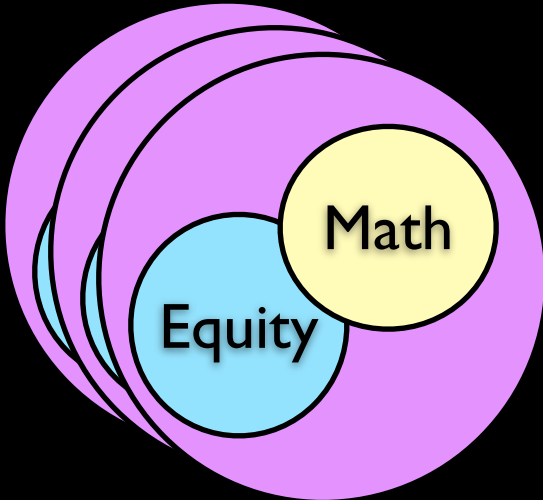


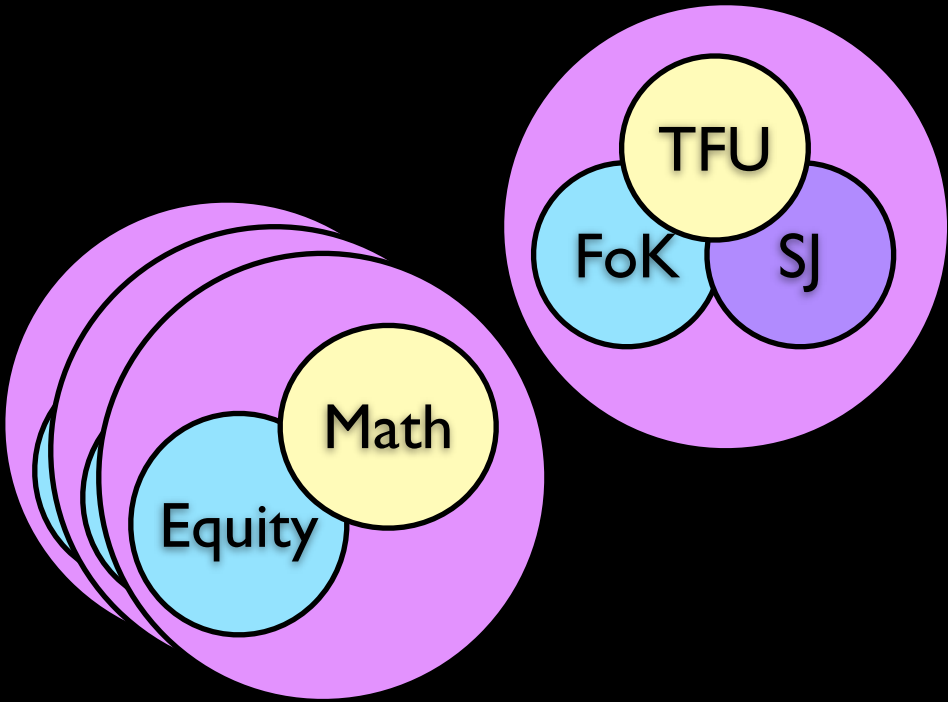
CAN EQUITABLE
MATHEMATICS PEDAGOGY
AND THE COMMON CORE
COEXIST IN EARLY
CHILDHOOD
CLASSROOMS?

ANITA A WAGER
UNIVERSITY OF WISCONSIN-MADISON

- RESEARCH BACKGROUND
- CURRENT PROJECT - 4KPD
- CCSSM & EQUITY
- MAKING IT WORK

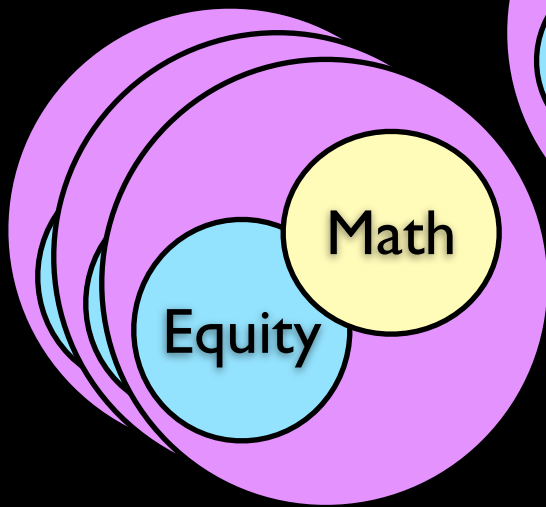


2004-2007

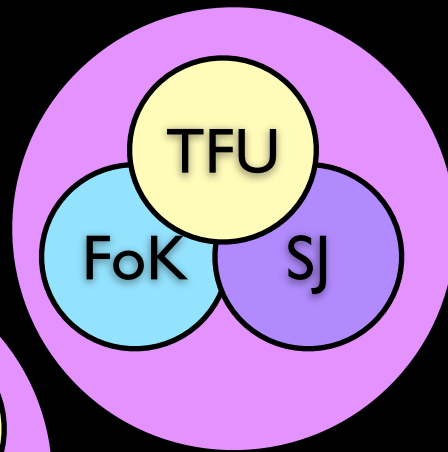


2004-2007

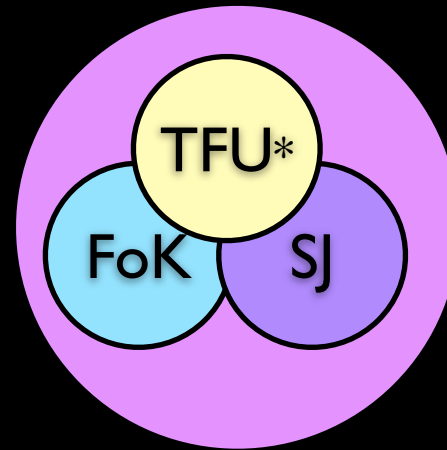
2008



2004-2007

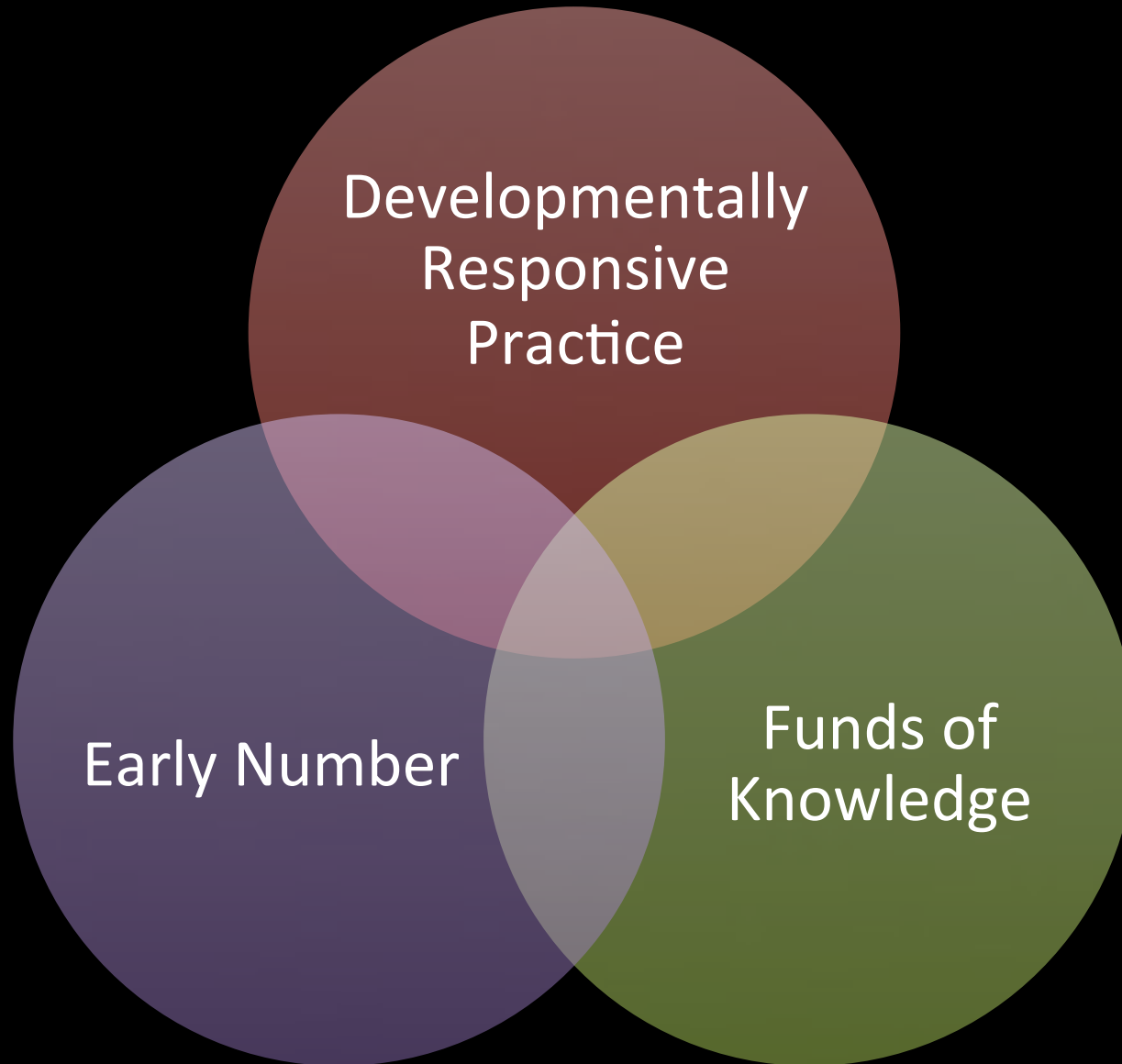


2008



2009



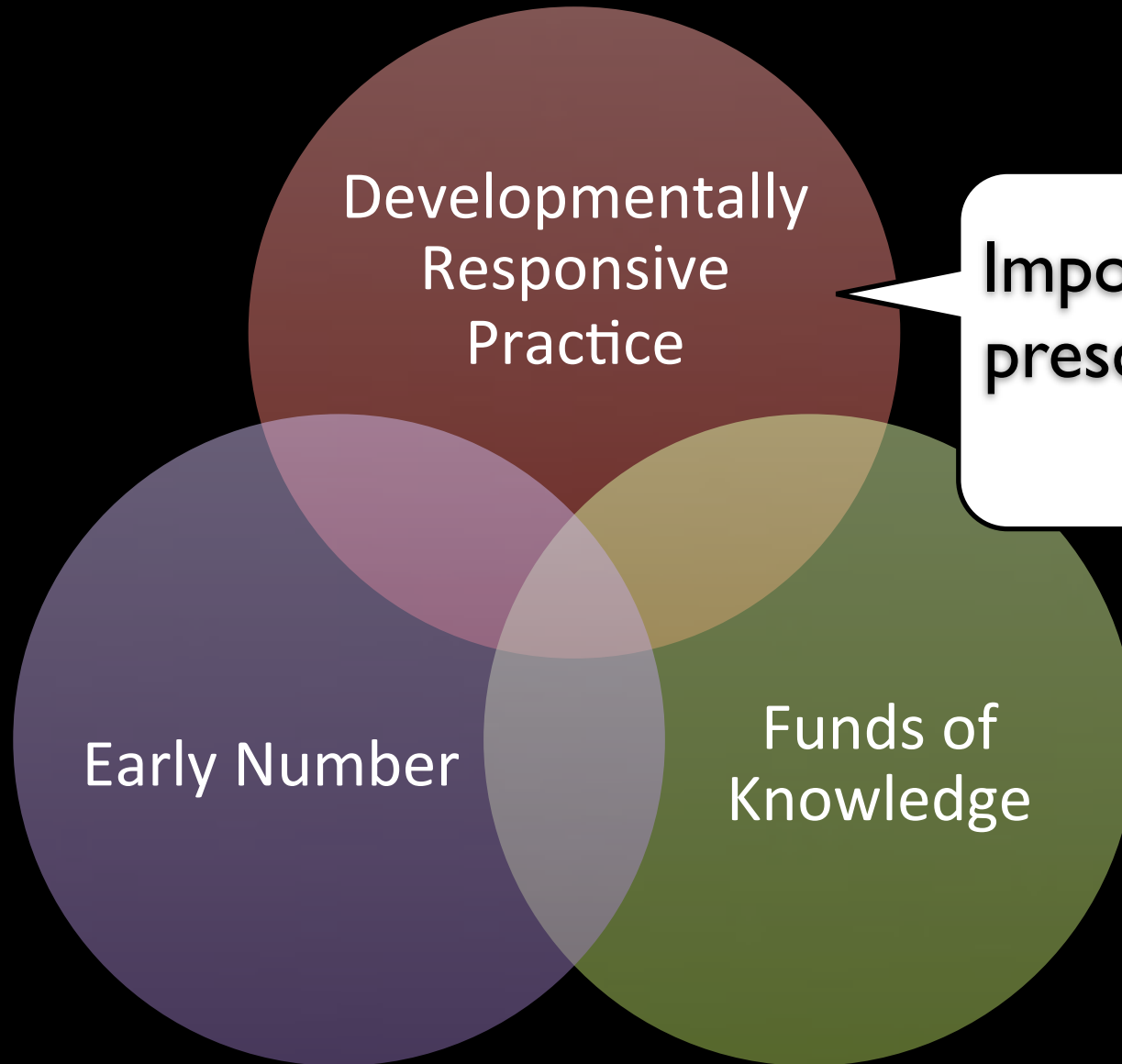


Early Number

Developmentally
Responsive
Practice

Funds of
Knowledge

- 3 cohorts of 15–20 4K teachers receive 4 free courses
 - Intro to ECE, Methods of ECE, Designing EC environments, Action research (early math and funds of knowledge woven into the courses)
- Co-taught by faculty in math education and early childhood education
- Weekly classes with assignments that relate to teachers work with a focal child and his/her family

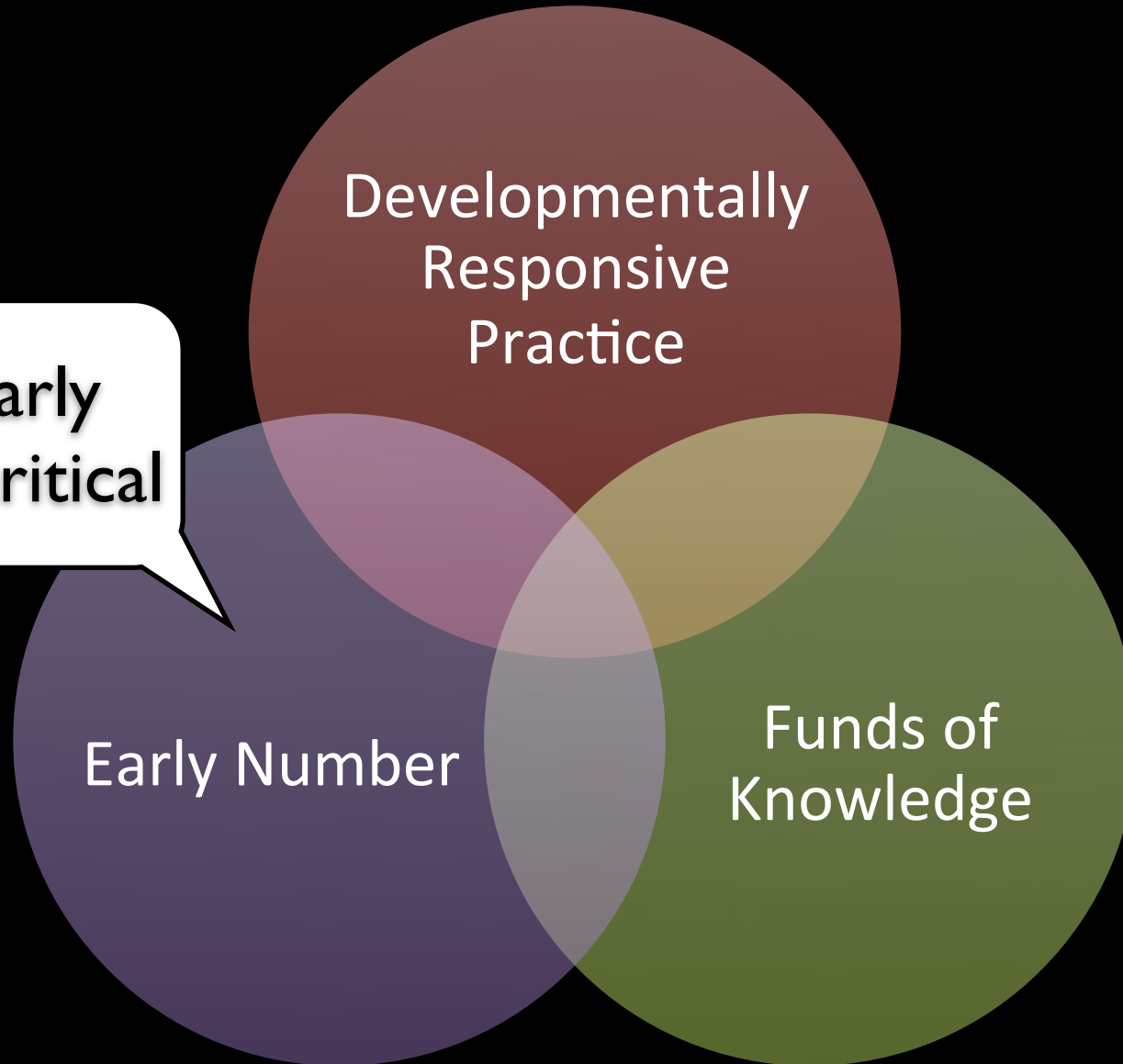


Importance of preschool and play

- Low income children of color are 1.5 SD behind white affluent peers entering K (Lee & Burkham, 2002)
- High quality early childhood education can mitigate risk factors associated with poverty (Camilli, Vargas, Ryan, & Barnett, 2010; National Research Council, 2009)
- 28% of 4 year olds are in public preK programs (NIEER, 2012)

- Play supports children's socio-emotional development (Bredekamp 2004)
- Prevents later behavioral issues (Bodrova 2009)
- Fosters development of academic skills (Perry, Dockett & Harley 2012)

Why early math is critical



Early Number

Funds of Knowledge

Developmentally Responsive Practice

- Early math shown to predict success in math and overall achievement (Duncan, et al. 2007; Romano, Kohen, Babchishin & Pagini 2010)
- Reduces later achievement gaps (Claessens & Engel, 2013)



**Why connection
to home &
community**

- Study families to understand and access family resources and challenge deficit perspectives (Moll et al. 1992)
- Use in classrooms to interrupt 'what has value'. Address power, social class, racism in and out of school (Rios-Aguilar et al. 2011; Zipin 2009; Rodriguez 2013)
- Children's interest in popular and media culture (Hedges 2011)

- When teachers understand how young children learn number & counting, they can support development across learning contexts
- Building on children's funds of knowledge makes a robust foundation for home-school relations and for learning
- Knowledge sharing between home & school informs families & teachers

- Develop & study PD for new public preK program
- Data collected:
 - Interviews
 - Reflections
 - Home visit interviews
 - PD discussions
 - Family math projects
 - Action research projects
- Nurture a professional learning community for teachers

Gave primacy to mathematics



Teachers
learned to
balance
math and
play



Teachers
learned to
balance
math and
play

PLAN - Intended Practice

PREPARE - Seed

RESPOND - Mathematize

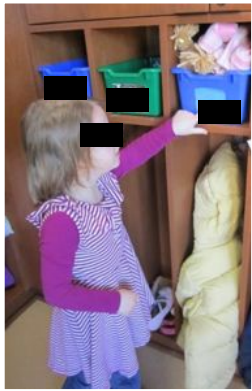
WHAT WE
LEARNED

Took up funds of
knowledge



In the Walmart in our classroom I noticed students using a lot of math vocabulary that I had not heard before such as cost, afford, more, less, buy, enough, money, and dollars. Students truly got into their roles as shoppers and employees and took ownership of the store by putting things away and keeping it organized. They talked about how much items cost and what items they wanted to buy. They counted and recounted the number of items in their carts to see if they had enough.

COUNTING CUBBIES AND CATERPILLARS



WHAT YOU DID: Erica, on Friday, February 15th, 2013 you wanted to know how many friends are in the class, so I said you could count the cubbies to find out. You counted the number of cubbies many times and even started over when you missed one. I asked if you could give something to each friend, and you chose caterpillars. You counted caterpillars from the basket until you were certain you had one for each friend. You put one caterpillar in each cubby and happily found you had the same number of caterpillars as friends.

WHAT YOU LEARNED: Erica, you worked so hard on your counting. You counted nine times from 1 to 14 and from 18 to 21, and you even said some bigger numbers. You practiced saying only one number for each cubby or caterpillar that you counted and you counted each object only once. You discovered that you had the same number of caterpillars as friends and that if you had one more caterpillar than there were cubbies that you had too many. You really learned a lot by counting!



WMELS

- V. B. EL. 1
Demonstrates an understanding of numbers and counting.
- V. B. EL. 2
Understands number operations and relationships.



WHAT YOU CAN DO NEXT: Erica, you love to count. You can count all objects you see and even compare how many of each you have. It will be fun to practice counting the numbers between 14 and 18 and the numbers over 21 as your math skills continue to get stronger. Keep on counting, Erica! 😊

Used holistic assessments

Action Research was a powerful tool for practice.



Action Research was a powerful tool for practice.

How can utilizing Funds of Knowledge, while recognizing the connection to our own classroom culture, support Cognitively Guided Instruction through Math Story be an effective tool that infuses math concepts into a play-based 4K setting?



Mathematical
thinking

Math in play

Supporting
agency

Connecting
to family

Holistic
assessment

Mathematical
thinking

Math in play

Supporting
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Mathematical
thinking

Math in play

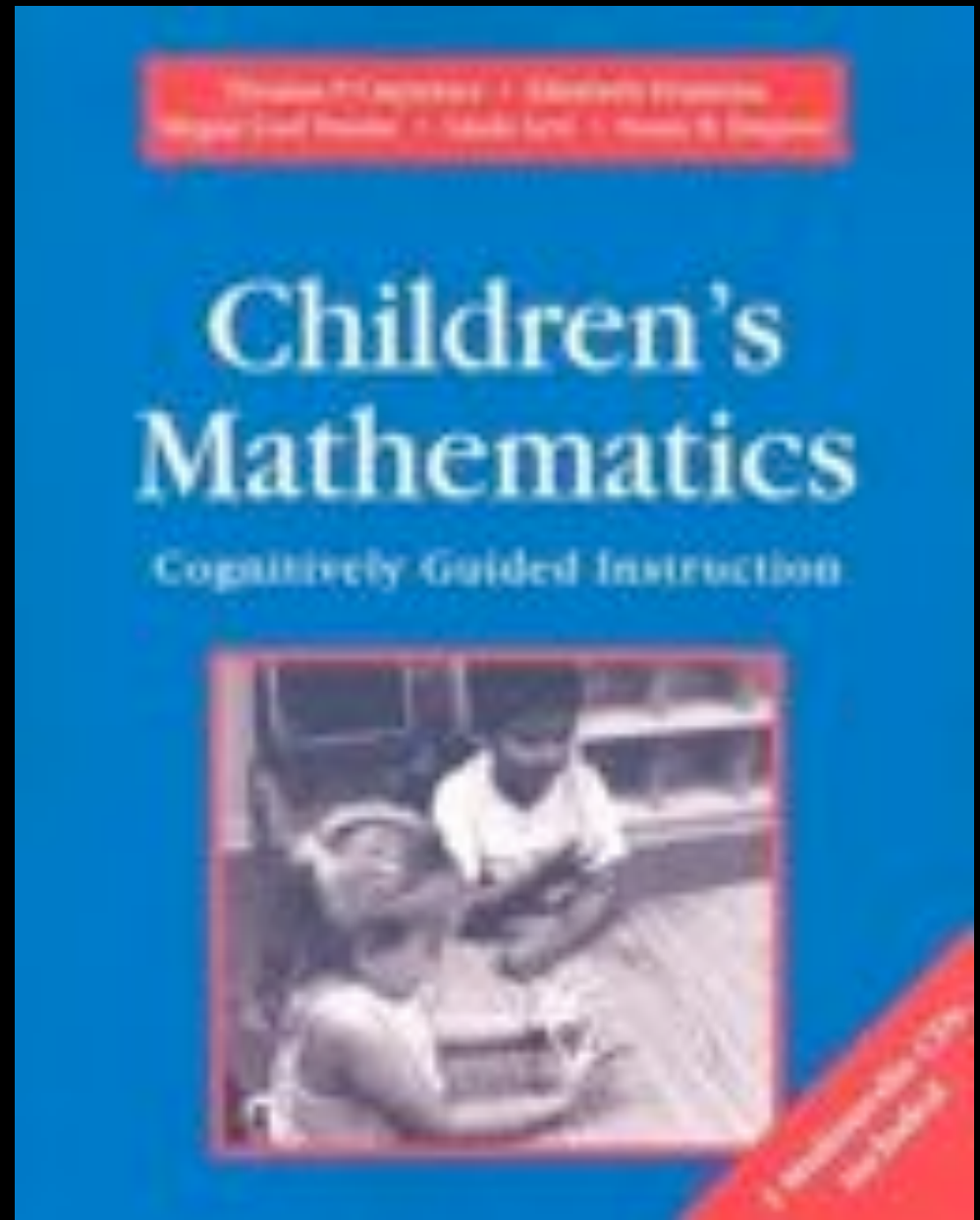
Supporting
agency

CCSSM

Connecting
to family

Holistic
assessment

Mathematical
thinking



Mathematical thinking

- **Represent and solve problems involving multiplication and division.**
 - CCSS.Math.Content.3.OA.A.1 Interpret products of whole numbers,
 - CCSS.Math.Content.3.OA.A.2 Interpret whole-number quotients of whole numbers,
 - CCSS.Math.Content.3.OA.A.3 Use multiplication and division within 100 to solve word problems in situations involving equal groups, arrays, and measurement quantities,
 - CCSS.Math.Content.3.OA.A.4 Determine the unknown whole number in a multiplication or division equation relating three whole numbers.

Math in play



Math in play

The standards establish what students need to learn, but they do not dictate how teachers should teach. Teachers will continue to devise lesson plans and tailor instruction to the individual needs of the students in their classrooms.

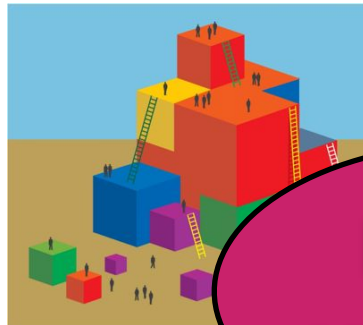
Magna-tile Construction



Momo you were building with magna-tiles on the rug one day. I asked you what you planned to build and you answered that you were building a house for your bear.
Momo: *I need to build a house for bear.*
Me: *Hmm, Your bear is big, how many squares do you think you will need to build it?*
Momo: *I think 36.*
Me: *Ok, let's count them when you are done.*
As you built, you attempted to count the squares. You missed a couple so decided to wait until you were all done. When you finished, we counted together. There were 21 squares.
Momo: *Wait, but these two aren't squares.*
Me: *Oh, they aren't but together they make a square.*
Momo: *I think we should count again.*
We counted again and counted 20 squares and 2 triangles.
Me: *You predicted you would need 36 squares. Did you use more or less squares than you thought you would use?*
Momo: *Mmmm, less because 20 is less.*

WHAT YOU LEARNED: Momo, you were doing so much when you were building this bear house! You were problem-solving how to build it, planning what you wanted to build, making predictions about how many tiles you would need and then you counted them! You even noticed that one of the squares was really two triangles which means you were noticing shapes and differences between shapes. What great observations!

WHERE TO GO NEXT: You are interested in counting objects and do this with only some help and only mixing up some of the teen numbers but with practice you will soon be counting on your own. You are noticing that shapes have differences and you can name many of the shapes. It will be great work to keep building and doing things that use shapes so you can keep learning what they look like and what they are called. As you keep building and doing puzzles, your problem-solving skills will grow and grow. Keep up the good work Momo!



Holistic
assessment

Name: _____ Teacher: _____ School Year: _____

Kindergarten Math Common Core Curriculum	Q1	Q2	Q3	Q4
Counting and Cardinality				
K.CC.1: Count to 100 by ones and by tens.				
K.CC.2: Count forward beginning from a given number (instead of 1)				
K.CC.3: Write numbers 0-20. Represent a number of objects with a written numeral 0-20.				
K.CC.4a Count objects to 20 saying number names in standard order, with one to one correspondence.				
K.CC.4b: Understands the last number said is the number of objects in a set.				
K.CC.4c: Understand that each successive number is 1 more (to 20).				
K.CC.5: Count objects in a scattered configuration to 10. Count up to 20 things in a line, array, or circle. (includes subitizing) Given a number 1 – 20, count that many.				
K.CC.6: Identifies greater than/less than/equal to up to 10 (including 10) by using matching/counting strategies.				
K.CC.7: Compares two numbers (0-10) presented as written numerals.				
Measurement and Data				
K.MD.1: Describe measurable attributes of objects, such as length or weight. Describe several measurable attributes of a single object.				
K.MD.2: Directly compare two objects with a measurable attribute in common, to see which object has "more of"/"less of" the attribute, and describe the difference.				
K.MD.3: Classify objects into given categories; count the numbers of objects in each category and sort the categories by count.				
Geometry				
K.G.1: Describe objects in the environment using names of shapes, and describe the relative positions of these objects using terms such as above, below, beside, in front of, behind, and next to.				
K.G.2: Correctly name shapes regardless of their orientations or overall size. (square, circle, triangle, rectangle, hexagon, cube, cone, cylinder, and sphere)				
K.G.3: Identify shapes as two-dimensional (lying in a plane, "flat") or three dimensional ("solid").				
K.G.4: Analyze and compare two- and three- dimensional shapes, in different sizes and orientations, using informal language to describe their similarities, differences, parts (e.g., number of sides and/"corners") and other attributes (e.g., having sides of equal length).				
K.G.5: Model shapes in the world by building shapes from components and drawing shapes.				
K.G.6: Compose simple shapes to form larger shapes.				
Operations and Algebraic Thinking				
K.OA.1: Represent addition and subtraction with objects, fingers, mental images, drawings, sounds, acting out situations, verbal explanations, expressions, or equations (within 10).				
K.OA.2: Solve addition and subtraction word problems, and add and subtract within 10 by using objects OR drawings to represent the problem.				
K.OA.3: Decompose numbers less than or equal to 10 into pairs in more than one way, e.g., by using objects or drawings, and record each decomposition by a drawing or equation (e.g., $5 = 2 + 3$ and $5 = 4 + 1$).				
K.OA.4: For any number from 1 to 9, find the number that makes 10 when added to the given number, e.g., by using objects or drawings, and record the answer with a drawing or equation.				
K.OA.5: Fluently add and subtract within 5.				
Number, Base Ten				
K.NBT.1: Compose and decompose numbers from 11 to 19 into ten ones and some further ones, e.g., by using objects or drawings, and record each composition or decomposition by a drawing or equation (e.g., $18 = 10 + 8$); understand that these numbers are composed of ten ones and and 1, 2, 3, 4, 5, 6, 7, 8, or 9 ones.				

Holistic
assessment

Family Math Activity Plan: Shelly

Notes about focal child:

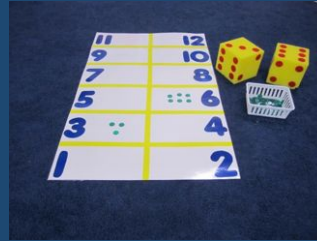
My focal child's family is from Tibet, and math skills are highly valued in his home. He speaks primarily in English, but in the home, his parents speak Tibetan. When he first started in my classroom in September, he did not appear to have much language, and did not initially demonstrate many mathematical ideas. However, around the third week of school, he suddenly began counting fluently using the wall calendar as a guide, and from there has blossomed in his knowledge of math concepts. He can count fluently to 39, and enjoys counting how many children are in the classroom, always counting who is there and who is not. He has learned to quickly scan the group to count children, and can often be found counting objects. He is very active and enjoys games where he can manipulate objects.

Funds of Knowledge Utilized:

I learned that his parents do math activities with him at home on the Ipad, and that he has a thirst for problem solving and counting. He often uses these skills in the home when he is playing video games. He enjoys math when he is engaged and thinking, and shies away from rote memorization. His father had previously worked as an inventory control supervisor, and knowledge of counting was extremely important to his work. He has tried to instill a love of numbers in his son.

Activity Description:

I made a number grid game for that could be used in many different ways. I wanted to have a game that could be differentiated easily, for although I am targeting my focal child with this game, I have children with many different skill levels in my classroom and I wanted a game that could be appropriate for all skill levels. My game board has 12 spaces. I used cut out numbers and plastic tape to define the number grid, then had it laminated. To play this game, you will need two large foam dice with dots. The object of the game is to roll two dice and place the number of chips that were rolled on the die onto the board. For my focal child, I want to see him roll the dice and count how many dots there are. I want to see if he can quickly scan the dots on the dice and pick up the appropriate number of chips and place them on the corresponding number. As my focal child often shows higher levels of mathematical knowledge, he could do this in several ways. He may roll a 4 and a 6 for instance. He may put 4 chips on the 4 space, and 6 on the 6 space, or he may add them together and put them on the 10. There are many ways this game can be played, and my purpose in making it this way was so I could expand on his learning by making it more open ended.



There is no "winner" when the game is played solo, but when two or more children play, they can see who rolled the highest number, and that child would be the winner.

The purpose of this game is to:

- See how well he can subitize numbers
- Have a game in which all children in the class can participate
- Create a way for him to manipulate objects while learning

Math Content:

<u>Counting</u>	<u>Quantifying</u>	<u>Connecting numerals to Quantities</u>
Verbal counting	Subitizing	Numeral recognition
Counts objects	Knows which set has more	Connects numerals to counted objects
	Various counting strategies	

Learning/Development promoted:

- ✓ Health and physical development – fine motor skills
- ✓ Language Development and Communication – Will need to verbalize numbers rolled when playing with a peer
- ✓ Cognition and General Knowledge – math concepts described below

Materials:

1. Game Board 2. Two sets of Foam dice (one with dots, one with numbers) 3. Chips or other manipulatives

Preparation:

I have made the game board out of tagboard, cutout numbers and plastic tape, but this could be modified any way the creator chooses. I have the dice and the manipulatives in my classroom, so I will just need to gather materials.

How will you know what is learned?

I will be watching and listening to my focal child as he rolls the dice and counts out the manipulatives. I will also see how he is distributing the chips, and see at what level he is able to subitize and count.

Possible modifications:

I created this game with the intent of modifying it as needed. My focal child will use dice with dots, but I will also have dice with numbers for those children who are not yet counting and are beginning to match numbers. Due to the open-ended nature of this game, there are many options for how it can be used, and each teacher will be able to use it in the way they see fit for a particular child.

Connecting
to family

Connecting
to family

Supporting
agency



Supporting
agency

The Standards for Mathematical Practice

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.



Supporting
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Me: “Do you notice any differences in the spinners?”

Kevin: *with a wry smile* “mine has 4, 5, 6 and yours has two 3,2,1”

Me: “who do you think will win”

Kevin: *smiling more* “me!”



Supporting
agency

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8. Look for and express regularity in repeated reasoning.

Big ideas in methods	But, But, But... CCSSM?	What to do...
Mathematical thinking	Whole ideas missing	Recognize where need to go and start early
Math in play	Local narrative raises concerns	Document learning - evidence
Connecting to family & community experience	Absent	Bring in to practice
Holistic assessment	Local narrative raises concerns	Add standard to learning story
Instruction that supports agency	Absent	Bring in to practice

THANK YOU!

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