

Teaching
Early
Math by
Providing
Language
Exploration

Increasing Math Language with Preschool Read-Alouds

Sarah R. Powell & Suzanne R. Forsyth

The University of Texas at Austin

The Meadows Center for the Prevention of Educational Risk

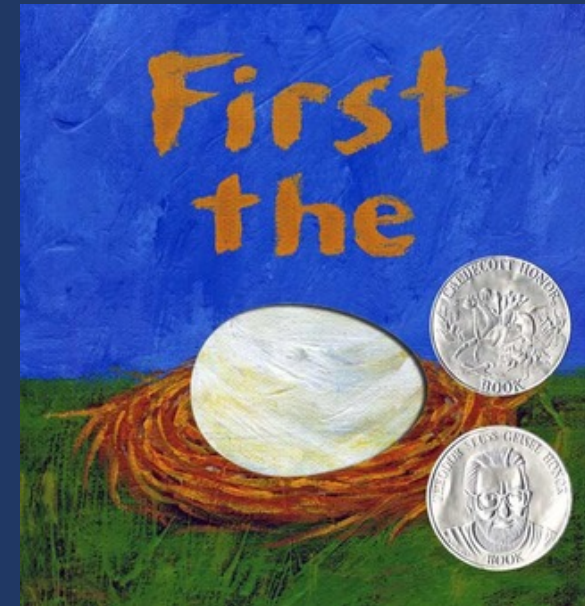
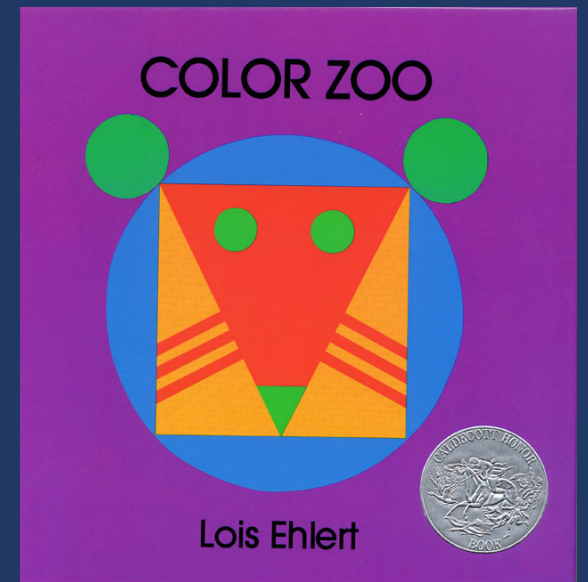
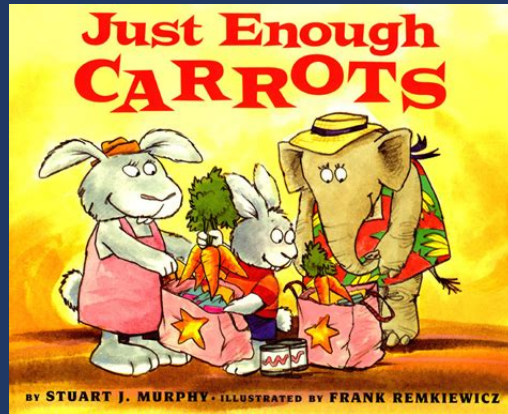
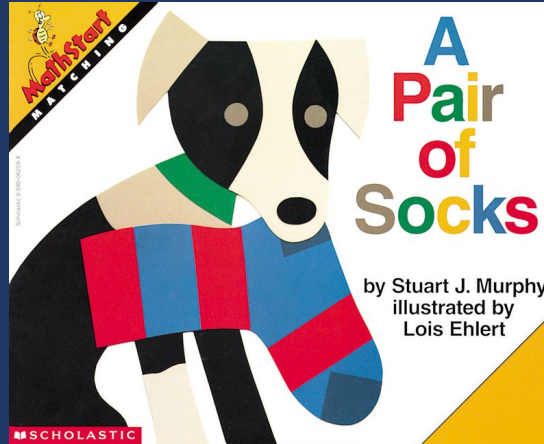
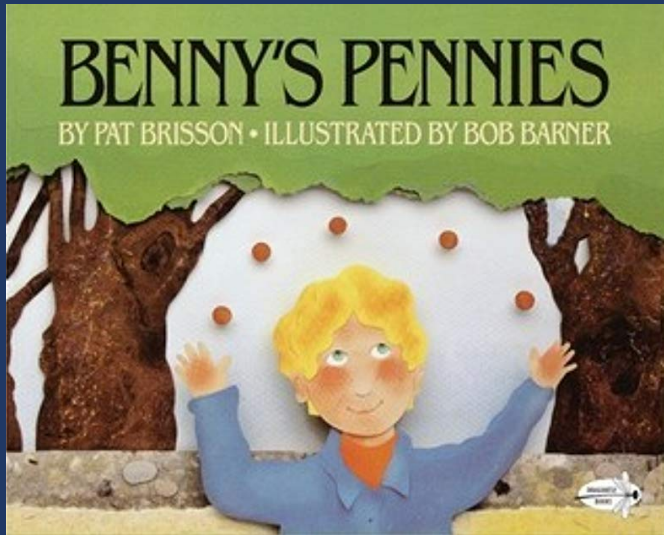
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Language Ability Linked to Elementary Math Skills

- Early Numeracy Skills
- Number Recall
- Math Facts
- Measurement
- Number Line Concepts
- Accuracy and Speed of Calculations
- Magnitude Comparison
- Fraction Competence
- Data Analysis
- Geometry

(Chow & Jacobs, 2015; Fazio, 1999; LeFevre et al., 2010; Purpura & Ganley, 2014; Purpura, Logan, Hassinger-Das, & Napoli, 2017; Seethaler, Fuchs, Star, & Bryant, 2011; Toll & Van Luit, 2014; Vukovic & Lesaux, 2013)

Building Vocabulary in Preschoolers



(Dickinson et al., 2018; Grior, Grimaldo, Vaughn, & Roberts, 2015; Lever & Sénéchal, 2011; Mol, Bus, & DeJong, 2009; Toub et al., 2018; Wasik & Bond, 2001; Whitehurst et al., 1988).

Language-Critical Subgroups

English Learners

- **Still learning basic English**
- Perform more poorly in math than native speakers

At-Risk Children (low SES)

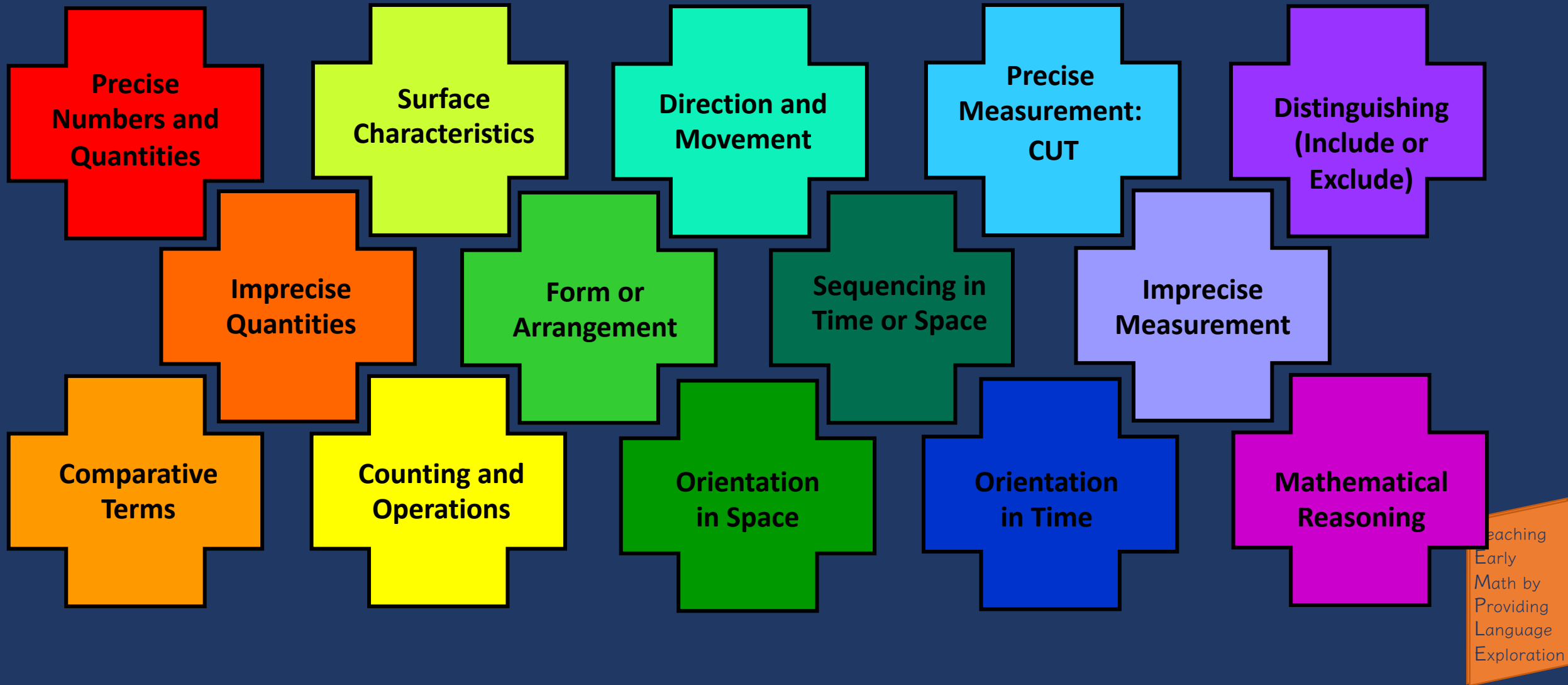
- **Poor general language skills**
- Perform more poorly in math than children from higher SES families

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Math Language

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Why is Math Language So Difficult?



Why is Math Language So Difficult?

What time is it?

How much time will that take?

Time

Three times two is six.

If you can hear me, clap one time.

Why is Math Language So Difficult?

Square

Why is Math Language So Difficult?

Next

next door

Front

in front of

Down

down the street

Up

call me up

Way

in the way

Out

out like a light

Why is Math Language So Difficult?

Get some play-doh **and** **make** a snake.

Three **and** two **make** five.

Why is Math Language So Difficult?

• Numbers and Quantity

• Time and Sequencing

• Location and Direction

• Compare or Distinguish

• Operational

• Reasoning

Fry's First 100 Words

1. the	21. at	41. there	61. some	81. my
2. of	22. be	42. use	62. her	82. than
3. and	23. this	43. an	63. would	83. first
4. a	24. have	44. each	64. make	84. water
5. to	25. from	45. which	65. like	85. been
6. in	26. or	46. she	66. him	86. called
7. is	27. one	47. do	67. into	87. who
8. you	28. had	48. how	68. time	88. am
9. that	29. by	49. their	69. has	89. its
10. it	30. words	50. if	70. look	90. now
11. he	31. but	51. will	71. two	91. find
12. was	32. not	52. up	72. more	92. long
13. for	33. what	53. other	73. write	93. down
14. on	34. all	54. about	74. go	94. day
15. are	35. were	55. out	75. see	95. did
16. as	36. we	56. many	76. number	96. get
17. with	37. when	57. then	77. no	97. come
18. his	38. your	58. them	78. way	98. made
19. they	39. can	59. these	79. could	99. may
20. I	40. said	60. so	80. people	100. part

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The Present Study: TEMPLE Read-Alouds

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TEMPLE Read-Alouds: Five-Year Program

Year 1

- Analyze and code math-focused children's books
- Survey educators and caregivers about read-aloud use
- Pilot pre-K read-alouds with educators

Year 2

- Conduct randomized study with pre-K educators
- Pilot pre-K read-alouds with caregivers

Year 3

- Conduct randomized study with pre-K educators and caregivers

Year 4

- Conduct randomized study with K educators
- Pilot K read-alouds with caregivers

Year 5

- Conduct randomized study with K educators and caregivers

Year 2 Study Design

Pretest

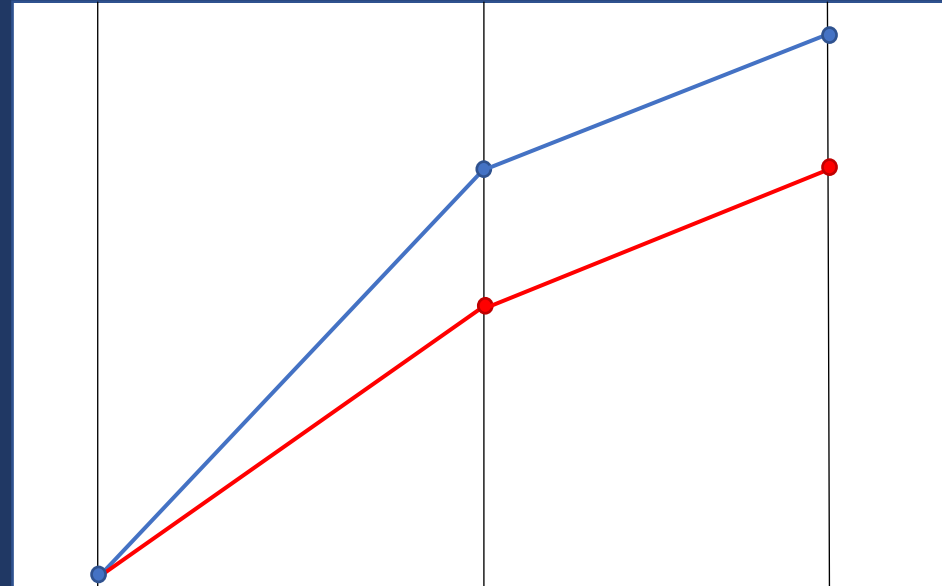
Group 1

Mid-test

Group 2

Posttest

TEAM – Texas Guidelines
PALM – PreK Math Language
TEMA-3 – Early Numeracy



Study Plan Year 3

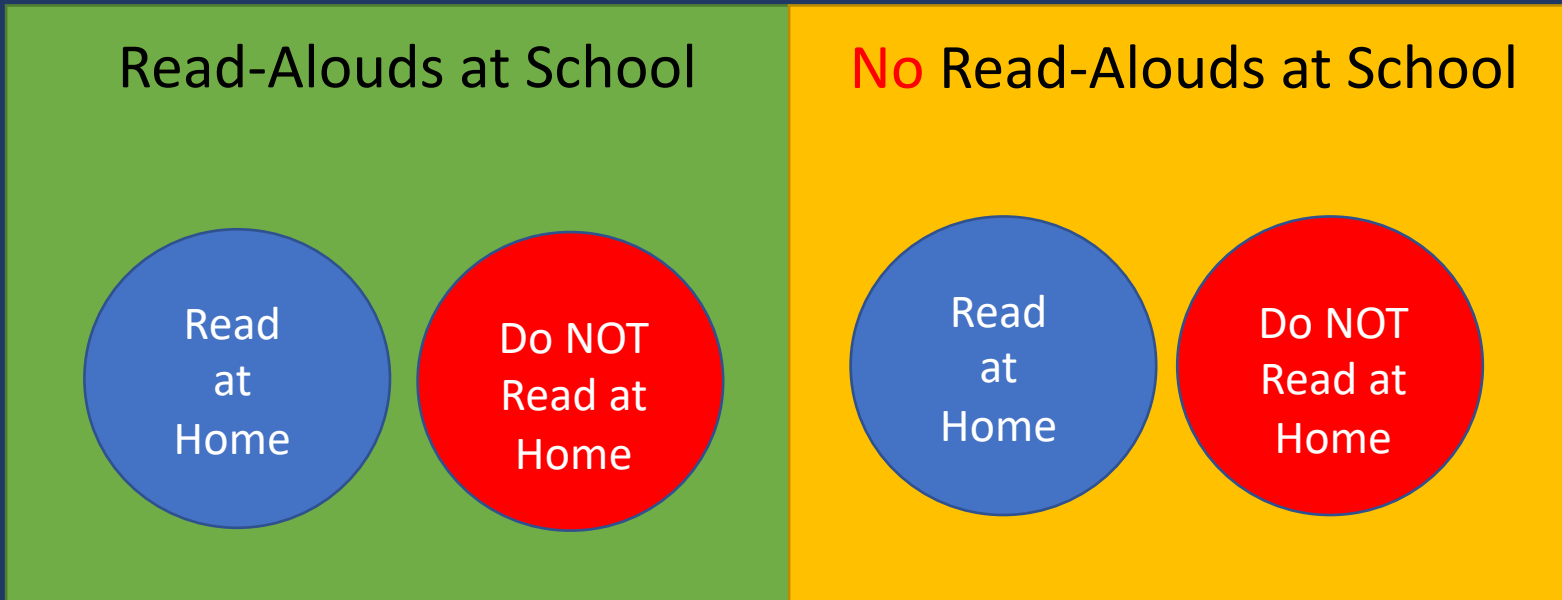
1. Recruit **schools**: Randomly assign **teachers**
 - Read 16 books over 16 weeks

and

2. Recruit **parents**: Randomly assign **parents**
 - Read 10 books over 10 weeks

Study Plan Year 3

Examining effects across 4 groups of children:



1. school and home
2. school only
3. home only
4. no read-alouds

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Read-Aloud Routine

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Dual Purposes of Project

1. Is using the **TEMPLE Read-Aloud Routine** with supplied books and materials effective in teaching **early math language** and **early numeracy skills**?
2. Professional development: modeling **how** to use a read-aloud routine to teach **early math concepts** with **any** math-focused story book.

Using the Read-Aloud Routine - Framework

1 book –
over 3 days
each week

Day 1

- Introduce the target math concept.
- Introduce the book.
- Introduce 3-5 new vocabulary words from the book.
- Read the book.
- Review the new vocabulary words.
- Make real-life connections through discussion.
- Reread the book, stopping at each target vocabulary word and using illustrations to clarify concepts and check for understanding.
- Explore new concepts and build skill with a hands-on activity.
- Use the skill as you go through the day.

Day 2

- Review concepts and vocabulary from the previous day's reading.
- Reread the book, stopping at each target vocabulary word and illustration to clarify concepts and check for understanding.
- Reinforce the new skill with another hands-on activity.
- Use the skill as you go through the day.

Day 3

- Review target vocabulary words.
- If desired, reread the book.
- Reinforce new skill with another related math activity.
- Ask students how they used their new math skills throughout the week.

Plan the Week



• Target a **math skill**

Counting

Adding to
and Taking
Away

Geometry
and Spatial
Sense

Measurement

Classification
and
Patterns

Plan the Week



- Target a **math skill**
- Select a **book**

engaging and
interesting

matches child
understanding

considers
cultural
background

Book Suggestions: ADDING TO/ TAKING AWAY SKILLS

1. Child uses concrete objects, creates pictorial models, and shares a verbal word problem for adding up to 5 objects.
 - *Just One More* by Jennifer Hansen Rolli (introduces idea of one more)
 - *Fish Eyes: A Book You Can Count On* by Lois Ehlert (adds 1 more)
 - *Rooster's Off to See the World* by Eric Carle (adds/subtracts in groups of 1 -5)
 - *Mouse Count* by Ellen Stoll Walsh (begins with 3, adds 3, then 4 more)
 - *Quack and Count* by Keith Baker (several ways to total 7)
 - *Twelve Ways to Get to 11* by Eve Merriam (twelve ways to total 11)
 - *What's New at the Zoo: An Animal Counting Adventure* by Suzanne Slade (sums of up to 20)
 - *Albert Adds Up* by Eleanor May (adds up to 11 and subtracts down to 0)
 - *Domino Addition* by Lynette Long (sums of 0 to 12)
 - *Teddy Bear Addition* by Barbara Barbieri McGrath (sums of up to 50)
2. Child uses concrete models or makes a verbal word problem for subtracting 0-5 objects from a set.
 - *Pete the Cat and His Four Groovy Buttons* by Eric Litwin and James Dean (four buttons pop off one by one)
 - *Benny's Pennies* by Pat Brisson (Benny spends 5 pennies)
 - *Monster Musical Chairs* by Stuart J. Murphy (from 6 down to 1 monster)
 - *Ten Flashing Fireflies* by Philemon Sturges (children capture fireflies 1 at a time from a group of 10)
 - *One Big Pair of Underwear* by Laura Gehl (groups of up to 9 animals all have 1 less item than needed for everyone, so there is always one left out)
 - *Elevator Magic* by Stuart J. Murphy (starts at 10th floor, goes down 2 floors, then 3, then 1, then 3 to get to the 1st floor)
 - *Albert Adds Up* by Eleanor May (adds up to 11 and subtracts down to 0)
 - *Teddy Bear Subtraction* by Barbara Barbieri McGrath

Book Selected: 2019 - 2020

Books Selected for TEMPLE Read-Alouds 2019-2010

Primary Math Strand	Objectives	Extension Strands and Objectives	Book Title and Focus	Examples of Math-Related Terminology Included in Book
Counting Skills				
	1, 3, 4, 5, 6, 8, 9	B.2, C.3	Ten Wiggly, Wiggly Caterpillars Counting down from 10	all, some, so much, on his own, left, too slow, in, through, inching up, off, late, all of the sudden
	1, 2, 3, 4, 5, 8, 6	D.4	Monster Math Counting up, then back down	each, amount, any, another, how many, left, little, monstrous, other, more, too many, away, at last, done, now
	7	D.4	First the Egg Sequencing terminology	first, then (allows for use of next, before, and after)
	8		Just Enough Carrots Comparing quantities	some, many, bunch, amount, a few, any, just, more, really, others, even, fewer, same, too many, enough, first, then, when
Adding To/ Taking Away Skills				
	1, 2	A.7, A.8, D.4	Rooster's Off to See the World Adding to/ taking away groups	some, few, enough, all, far, slowly, very, more, so much, behind, over, overhead, away, turned, without, began, after, finally, morning, just then
	1	C.3	Quack and Count Adding to 7	count, row, on, in, reaching high, start, as, plus
	2	A.7	Benny's Pennies Start with 5, subtract by 1 to 0	penny, out, in, on, morning, buy, sell, then (allows for use of ordinals/sequencing)

Plan the Week

- Target a **math skill**
- Select a **book**
- • Determine target **vocabulary** terms (words or phrases)

3 to 5
focus terms

child-friendly
definition

print terms –
cards or a
poster

gesture,
object, or
picture

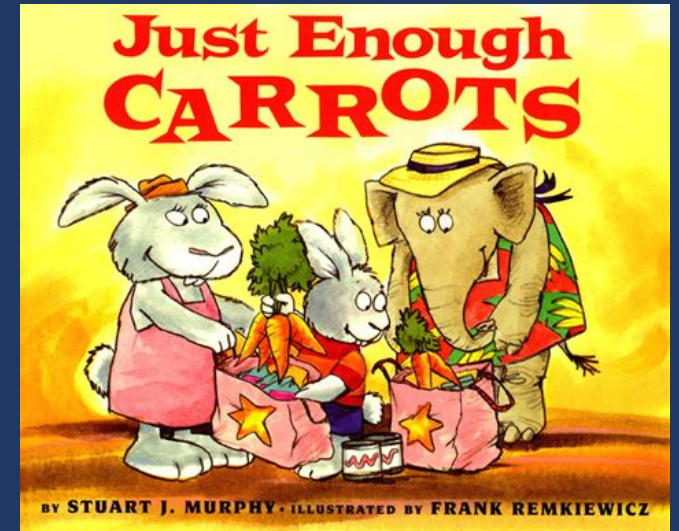
Vocabulary Ideas: EARLY MATH TERMS

Term	Considerations
Above	
Add	We add two numbers together. Watch this television ad .
After	
Again	
Alike	
Always	
And	Rachel and Juan are friends. Five and two equals seven. I had four and then Mike gave me more. I had four and then Mike took away two.
Balance	I can balance on one foot. We can balance the scale.
Before	Place the circle before the square. I brush my teeth before bed. I be four . (incorrect grammar)
Behind	
Below	
Between	
Big Bigger Biggest	
Bottom	This block is on the bottom of the stack. Please sit on your bottom .

Vocabulary Cards: JUST ENOUGH CARROTS

some

part of it



any

more than 0

Plan the Week

- Target a **math skill**
- Select a **book**
- Determine target **vocabulary** words and phrases
- Brain-storm **real-life connections**



Real-Life Connections: MEASUREMENT

by Anna Kang illustrated by Christopher Weyant

You Are (Not) Small



I use measurement skills when I:

- decide which of my friends is the tallest.
- determine whether the whole Gatorade will fit in my cup.
- realize which bucket holds the most sand.
- decide which rock is heavier.
- follow my schedule for the day.
- wait 5 minutes before I can have my turn.

Sometimes do you feel small?
When do you feel small?
Sometimes do you feel really big?
When do you feel really big?

Why do you think you sometimes feel like you're small...and other times you feel like you're big?

Plan the Week

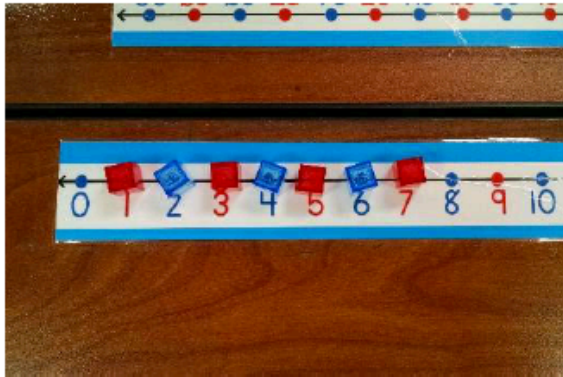
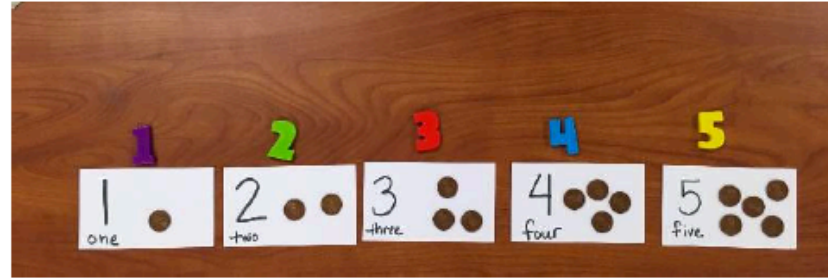
- Target a **math skill**
- Select a **book**
- Determine target **vocabulary** words and phrases
- Determine **real-life connections**
- Plan 3 different math **enrichment activities**
 - **Hands-on or whole body**
 - **Element of fun or discovery**



Activities: COUNTING



Using index cards, write the target number(s) on them and have children place (or glue) the matching quantity of small objects onto the card.



Using a number line, have children place counters on each number as they count.



Have children put magnetic numerals in order using a number line. (As they master numeral recognition, remove the number line and see if they can put them in order without one.)

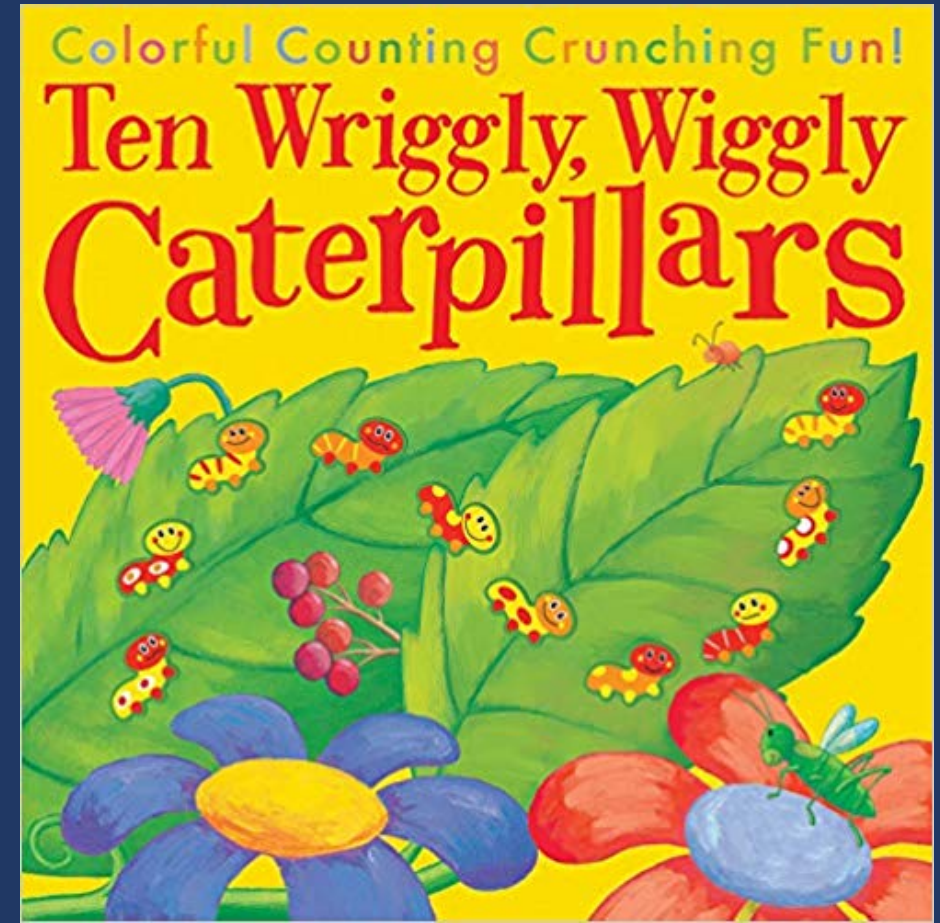


Activities: COUNTING

Rocket Ship Blast-Off

- Point out that in the story, the number of caterpillars was going backwards from 10 all the way to 1.
- Point out that when a rocket ship blasts off, we count down from 10 to 0 before it takes off.
- Ask students to pretend they are rocket ships.
 - Start by crouching low to the ground.
 - Count down 10, 9, 8, 7, 6, 5, 4, 3, 2, 1, 0 (together).
 - Call out “blast-off,” while jumping up and reaching towards the sky.
- Repeat several times.

Variation: Have the numerals 10 to 0 printed out so that you can point to them as you all count backwards together.



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Implementation

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Day 1

Introduce and Preview the Book



Preview and activate **prior knowledge**:

- Show front cover
- Picture walk
- “What do you think this story is about?”
- “What do you already know about....”

Day 1

Introduce and Preview the Book

Teach Key Vocabulary



Briefly introduce **target vocabulary terms**:

- **3 – 5 terms**
- **in print**
- **child-friendly definition**
- **provide an object, picture, or gesture**

Day 1

Introduce and Preview the Book

Teach Key Vocabulary

Read the Book



Read straight through **without stopping to question/comment:**

- **Allow the focus to be understanding the story**
- **Pause briefly before turning pages**

Day 1

Introduce and Preview the Book

Teach Key Vocabulary

Read the Book

Make Real-Life Connections

INTERACTIVE

Discuss the **story**:

- Ask **general questions** about the story.
- Ask about **how children's lives connect** to the story, characters, and concepts.

Day 1

Introduce and Preview the Book

Teach Key Vocabulary

Read the Book

Make Real-Life Connections

Re-read the Book

INTERACTIVE

Review **target terms**

Provide a **gesture** for students to use when they hear one

- Pause at **target vocabulary terms**
- **Ask questions**
 - about **illustrations** and the **math** in the story
 - or real-life connections

Day 1

Introduce and Preview the Book

Teach Key Vocabulary

Read the Book

Make Real-Life Connections

Re-read the Book

Practice Skills with An Activity

INTERACTIVE

- Connect to the **story**, **math**, and **characters** from the book
- Ask questions that require use of new math **vocabulary terms**

Day 2

Review Key Vocabulary

Re-read the Book

Practice Skills with An Activity

INTERACTIVE

Day 3

(Re-read the Book)

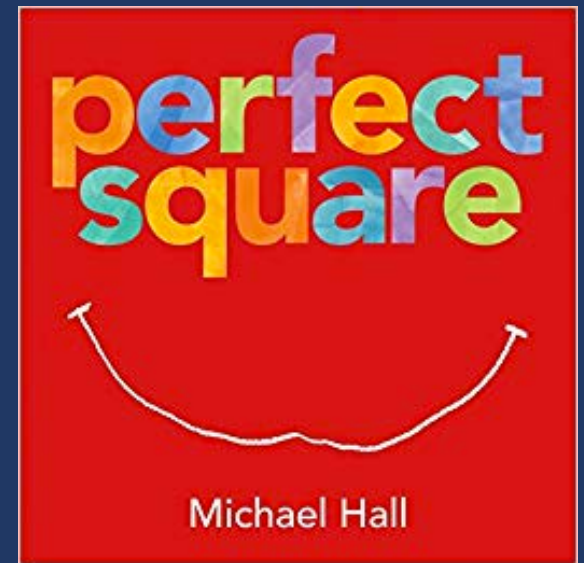
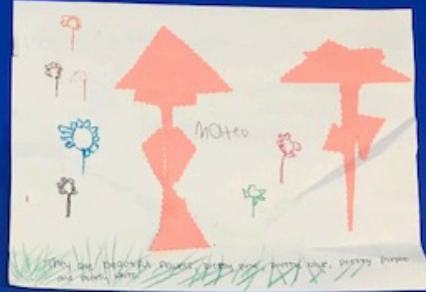
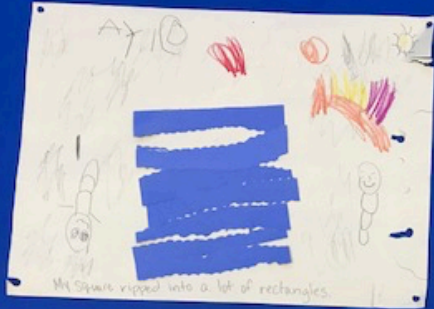
Review Key Vocabulary

Revisit Real-Life Connections

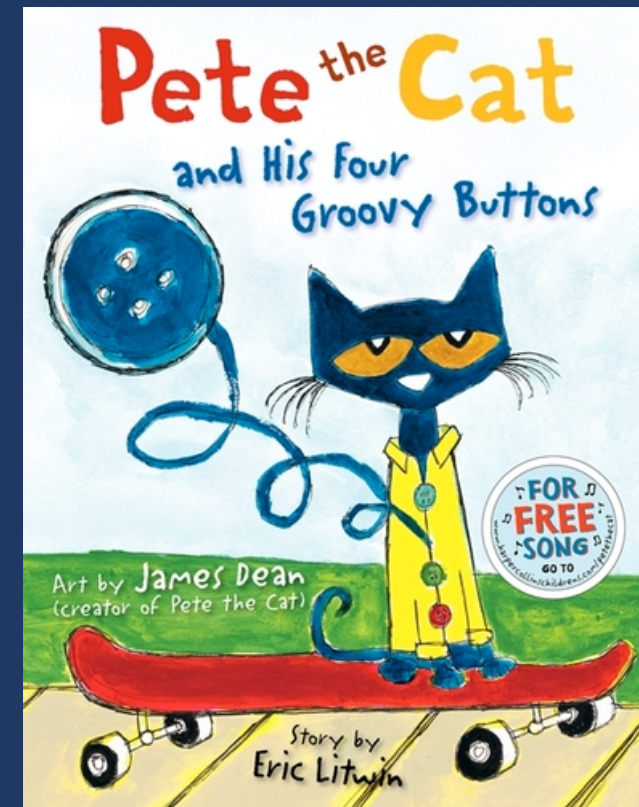
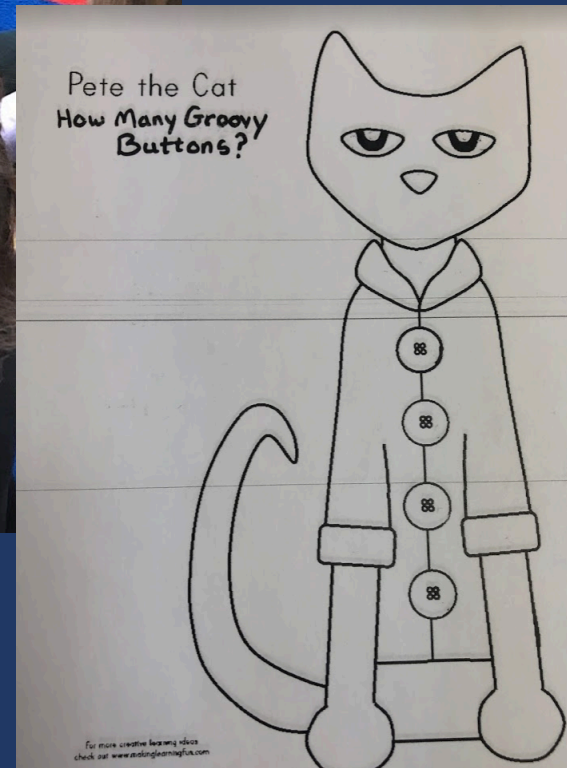
Practice Skills with An Activity

INTERACTIVE

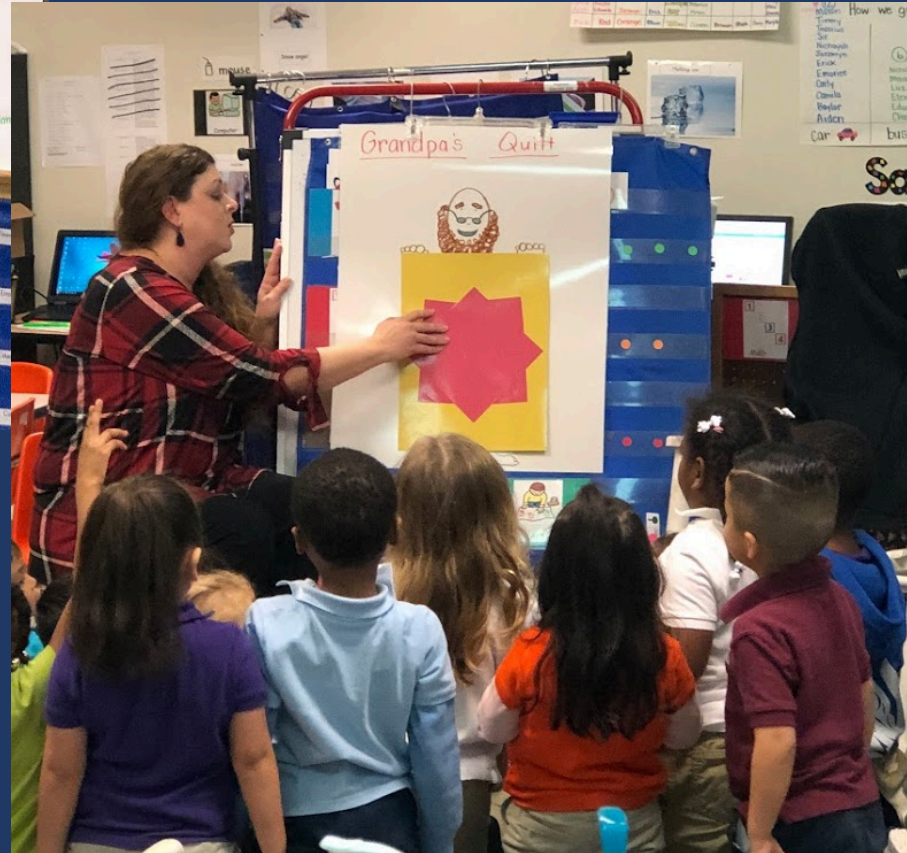
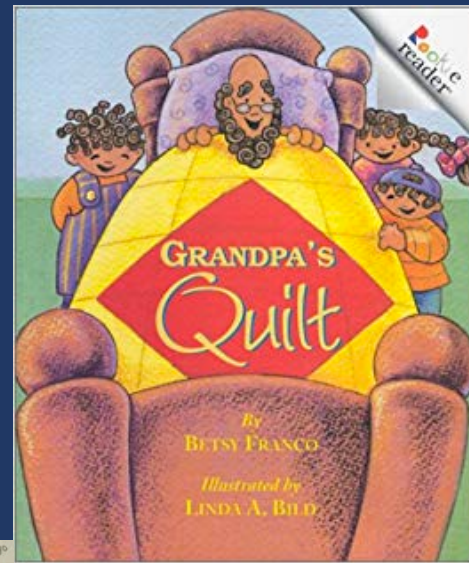
Some Examples



Some Examples

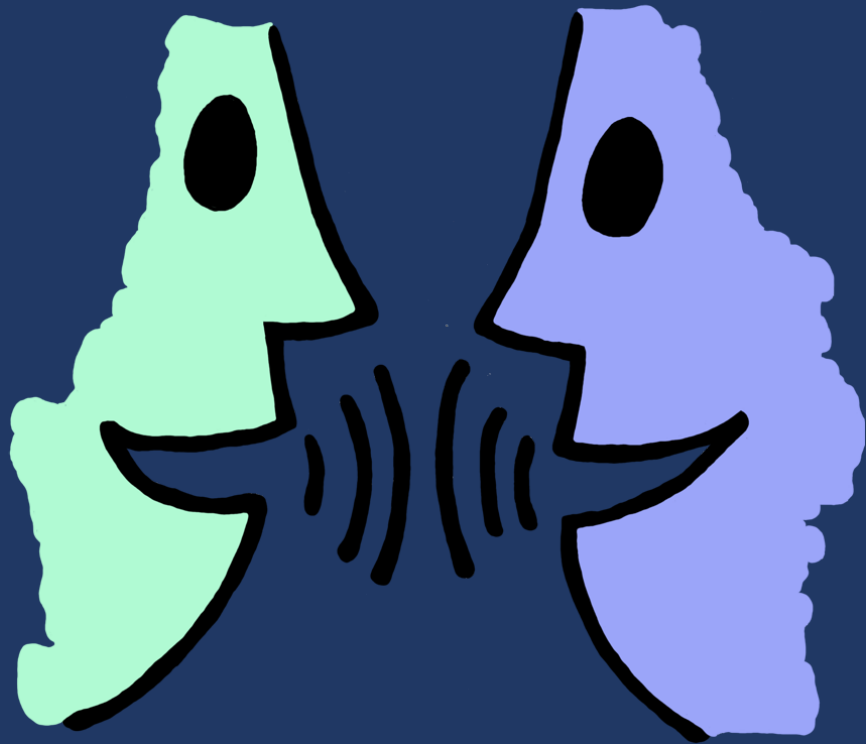


Some Examples



Journal

Now, YOU try it!



Math Read-Alouds Planning Sheet

Book Title: _____

Focus Terminology: (list words of interest; circle or highlight terms selected for instruction)

Real Life Connections (to discuss on Day 1):

Activity

Day1: _____

Activity

Day2: _____

Activity

Day3: _____

Other Notes/Needs:

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Suzanne Forsyth

srforsyth@austin.utexas.edu



Sarah Powell

srpowell@austin.utexas.edu



@sarahpowellphd

www.sarahpowellphd.com



The University of Texas at Austin
College of Education