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Numeracy Counts: The Early Grade Math Assessment (EGMA)

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About the Presentation

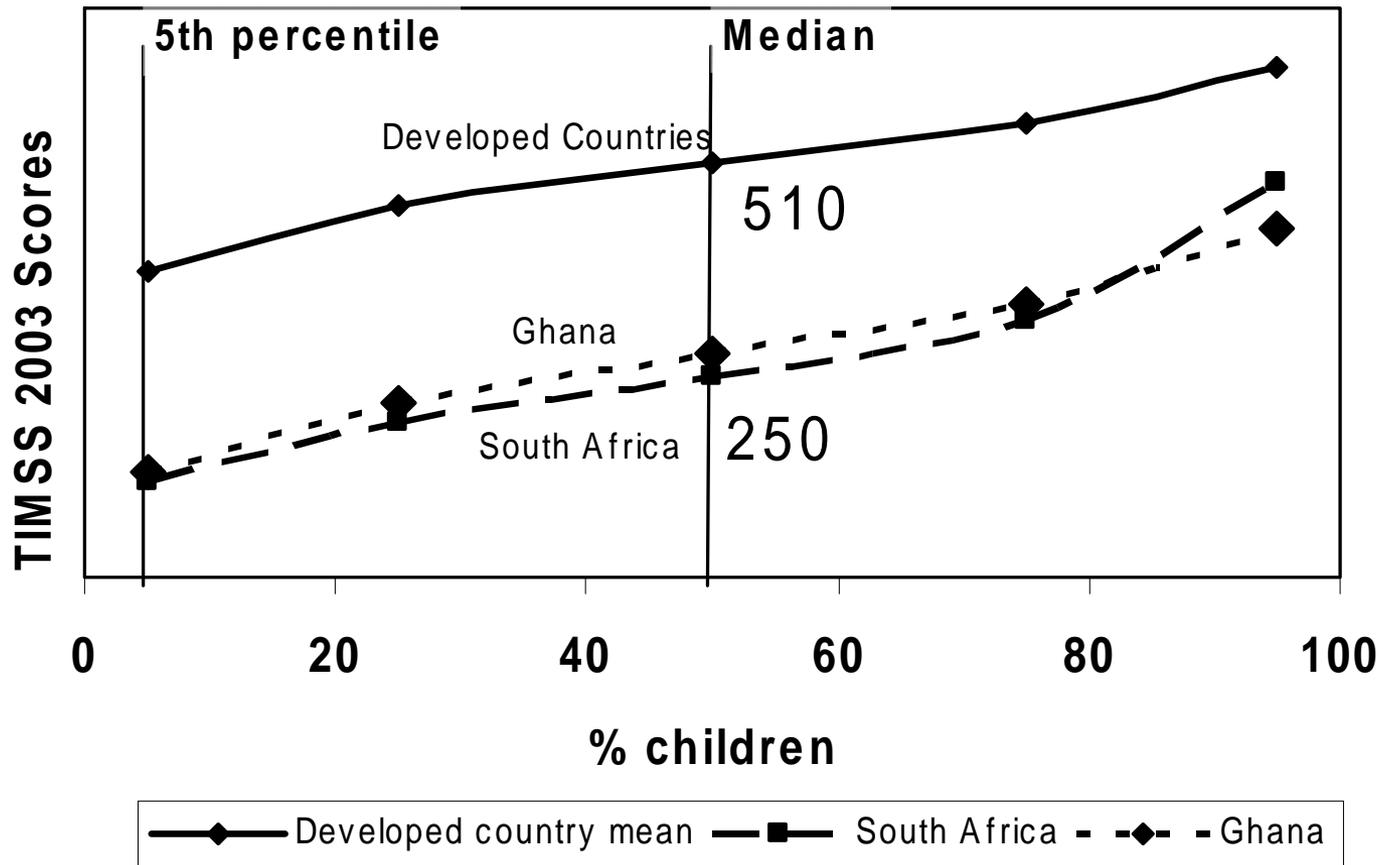
- This presentation was prepared for the Comparative and International Education Society (CIES) annual meeting, Charleston, South Carolina, March 25, 2009.
- The Early Grade Math Assessment (EGMA) is an instrument designed to measure the extent to which schoolchildren in early primary grades are learning math skills.
- The work described here is being carried out under the United States Agency for International Development's (USAID's) EdData II project, led by RTI International. EGMA is part of EdData II Task Order Number 2, EHC-E-02-04-00004-00.

Why Math?

- Used every day
- Increased focus by U.S. Department of Education
- Jobs require math
- Competitive job market

Differences in Math Scores

Developed countries compared to Africa



Why an EGMA?

- Early assessment
- Quick, efficient (15 min.)
- Research-based
- Cost effective
- Increases awareness

Essential Components: What do we know?

	US NAEP	TIMSS	South Africa	Jamaica
Number & Operations	X	X	X	X
Measurement	X	X	X	X
Geometry	X	X	X ¹	X ¹
Data Analysis/Data Handling	X	X	X	X
Algebra	X	X ²	X ³	X ³

¹ In South Africa and Jamaica this is referred to as Shape & Space.

² The TIMSS algebra content for the fourth grade is known as patterns and relationships.

³ This is categorized in South Africa and Jamaica as Pattern & Algebra.

Essential Components: Number and Operations

National Council of Teachers of Mathematics

Grade Level	Goal
Prekindergarten	<ul style="list-style-type: none">• Whole numbers• Counting, cardinality, comparison
Kindergarten	<ul style="list-style-type: none">• Represent, compare, order whole numbers• Join, separate sets of objects
First grade	<ul style="list-style-type: none">• Understand addition, subtraction• Strategies for basic addition, subtraction facts
Second grade	<ul style="list-style-type: none">• Understand<ul style="list-style-type: none">– Base-ten numeration– Place-value concepts (fluency with multi-digit addition, subtraction)

Essential Components: Number and Operations

Objectives for kindergarten through second grade:

- Similarities across countries
 - Examples: Know, use number names, symbols; compare, order sets of objects
- Within a country can vary across states, schools
 - Examples: Estimate quantities, join, separate objects
- Across countries can vary
 - Examples: Use of symbols ($<$, $=$, $>$), identify odd, even numbers

Essential Components: Number and Operations

End of Second Grade							
Description	North Carolina	Texas	San Francisco	Kenya ¹	South Africa ²	Jamaica	Botswana ³
Single-digit addition	X	X	X	X	X	X	X
Read, write addition equations	X	X	X	X	X	X	X
Single-digit subtraction	X	X	X	X	X	X	X
Read, write subtraction equations	X	X	X	X	X	X	X

¹ Objective is to work with single-digit addition and subtraction equations up to 99.

² For addition and subtraction learning, objective is to work with whole numbers and solutions to at least 34.

³ Works with numbers up to 20.

Essential Components: Geometry

National Council of Teachers of Mathematics

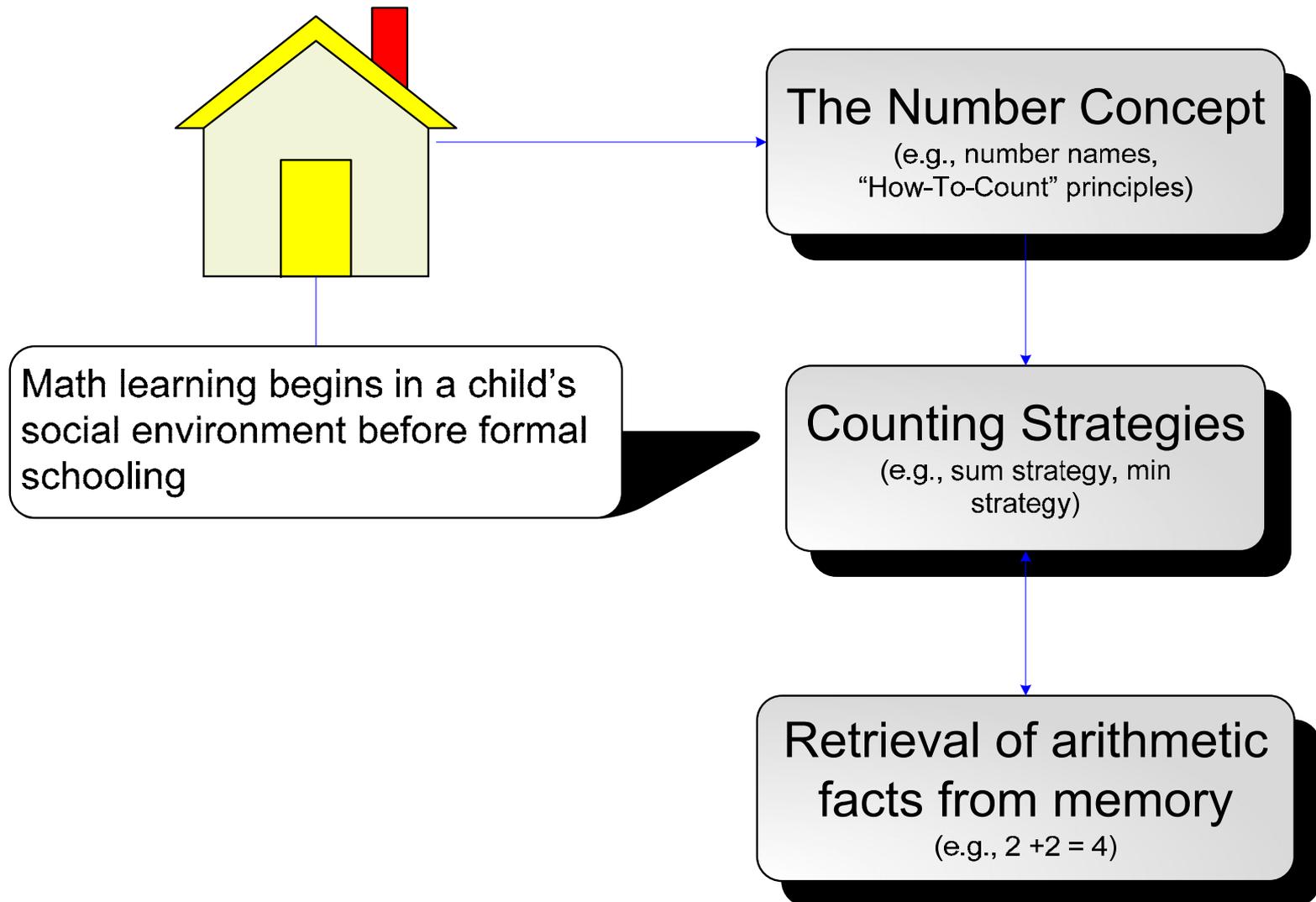
School Year	Overall Goals
Prekindergarten	<ul style="list-style-type: none">• Identify shapes• Describe spatial relationships
Kindergarten	<ul style="list-style-type: none">• Describe shapes, space
First grade	<ul style="list-style-type: none">• Compose, decompose geometric shapes
Second grade	_____

Essential Components: Geometry

Objectives – kindergarten through second grade:

- Similarities across countries
 - Recognize, name two-dimensional shapes (triangles, rectangles, circles)
 - Recognize, name three-dimensional shapes (spheres, cones, cylinders)
- Differences across countries
 - Develop spatial awareness (communicate location of objects in relation to surroundings)
 - Combine shapes to make new shapes
 - Explore shape attributes

Essential Components: Children's Knowledge



EGMA Contents

Number and Operations

- Oral Counting Fluency
- One-to-One Correspondence
- Number Naming Fluency
- Quantity Discrimination
- Number Line Estimation
- Word Problems
- Addition and Subtraction

EGMA Contents

Geometry

- Shape Recognition
- Shape Attributes
- Pattern/Number Extension

Counting Tasks: One-to-One Correspondence

Represents collection of objects through application of number words.

- Child needs
 - Knowledge of number-word sequence.
 - To keep track of each counted, uncounted object—tagging.
 - To coordinate two processes at once.

Snapshot of Counting: One-to-One Correspondence

TASK 2: COUNTING: ONE-TO-ONE CORRESPONDENCE - PRACTICE ITEM

MATERIALS: SHEET "A"

STOP RULE: STOP THE CHILD IF S/HE DOUBLE COUNTS A CIRCLE, INCORRECTLY COUNTS A CIRCLE, OR IF TIME ON THE STOPWATCH RUNS OUT

SCORING: RECORD 1) THE LAST SPOKEN CORRECT NUMBER AND 2) THE RESPONSE THE CHILD GIVES TO YOUR FOLLOW UP QUESTION

DIRECTIONS: PLACE SHEET "A" WITH THE FOUR CIRCLES IN FRONT OF THE CHILD.

SWEEP YOUR HAND FROM LEFT TO RIGHT OVER THE CIRCLES AND SAY: **Here are some circles. I want you to point and count these circles for me.**

POINT TO FIRST CIRCLE AND SAY: **Start here and count the circles.**

HOW MANY CIRCLES DID THE CHILD COUNT: _____

IF THE CHILD DOES NOT SAY THE NUMBER AFTER COUNTING THE CIRCLES SAY: **How many circles are there?**

NUMBER OF CIRCLES CHILD SAYS THERE ARE: _____

IF CHILD DOES NOT RESPOND OR RESPONDS WITH THE INCORRECT ANSWER, COUNT THE CIRCLES OUT LOUD, POINTING TO EACH ONE AND SAY: **One, two, three, four, there are four circles. Now you count the circles.**

IF THE CHILD DOES NOT SAY THE NUMBER OF CIRCLES AFTER COUNTING THEM, SAY: **How many circles are there?**

IF CHILD SAYS "FOUR" SAY: **That's right, four. Let's do another one.**

IF CHILD DOES NOT SAY "FOUR" SAY: **There are four, let's do another one.**

Quantity Discrimination

- Ability to make judgments about differences
 - Use of mental number line
 - Ability to make magnitude comparisons
- Children will demonstrate
 - Knowledge of communicating the bigger number
 - Understanding of where numbers are positioned on a number line

Snapshot of Quantity Discrimination

TASK 4: QUANTITY DISCRIMINATION MEASURE – EXERCISE ONE

MATERIALS: SHEET "D1" AND COVERSHEET

STOP RULE: STOP THE CHILD IF S/HE GETS 4 ERRORS ONE RIGHT AFTER THE OTHER.

SCORING: RECORD ONE POINT FOR EACH CORRECT RESPONSE.

DIRECTIONS: PLACE SHEET "D1" WITH THE COVERSHEET COVERING THE ITEMS IN FRONT OF THE CHILD. WHEN YOU ARE READY TO BEGIN, BRING COVERSHEET DOWN TO REVEAL THE FIRST NUMBERS TO THE CHILD.

SAY: **Look at these numbers. Which one is bigger?**

IF THE CHILD DOES NOT RESPOND TO AN ITEM, REPEAT THE QUESTION ONCE, WAIT THREE SECONDS, MARK WITH A SLASH "/" IF THERE IS STILL NO ANSWER, MOVE ON TO THE NEXT ITEM.

REPEAT THE QUESTION FOR EACH OF THE ITEMS. CIRCLE THE CHILD'S RESPONSE FOR EACH ITEM.

- | | | | |
|----|----|----|-------|
| 1. | 8 | 6 | _____ |
| 2. | 15 | 3 | _____ |
| 3. | 4 | 16 | _____ |
| 4. | 11 | 10 | _____ |
| 5. | 20 | 19 | _____ |
| 6. | 7 | 12 | _____ |

CIRCLE THE ANSWER GIVEN BY THE CHILD.
FOR NON-ANSWERS, PLACE A SLASH "/" ON THE
SPACE AT THE END OF THE ROW.

PLACE THE TOTAL RESPONSES CORRECT ON
THE LINE FOR CHILD SCORE.

Child Score: _____ / 6

IF CHILD GETS FOUR INCORRECT IN A ROW, DISCONTINUE AND GO TO TASK 5.

Addition/Subtraction Problems

- Children start school with some basic knowledge of addition and subtraction concepts.
- With age and experience, perception of difficulty for addition and subtraction problems and strategies used in solving them change¹
- Children who are able to do the previous skills, such as counting and quantity discrimination, will demonstrate some knowledge of these skills.

¹ Siegler, R. S. (2003). Implications of cognitive science research for mathematics education. In Kilpatrick, J., Martin, W. B., & Schifter, D. E. (Eds.), *A research companion to principles and standards for school mathematics* (pp. 219-233). Reston, VA: National Council of Teachers of Mathematics.

Snapshot of Addition/Subtraction

TASK 7: ADDITION/SUBTRACTION PROBLEMS – PRACTICE ITEMS

MATERIALS: SHEET “F1”, AND COUNTERS

STOP RULE: STOP THE CHILD FROM CONTINUING IF S/HE GETS 4 ERRORS ONE RIGHT AFTER THE OTHER

SCORING: ENTER CHILD’S ANSWER ON THE LINE FOR EACH ITEM. CIRCLE “0” IF ANSWER WAS INCORRECT. CIRCLE “1” IF ANSWER WAS CORRECT. FOR EACH OF THE QUESTIONS: IF THE CHILD DOES NOT RESPOND, CIRCLE THE NR. IF THE CHILD REFUSES TO ANSWER, CIRCLE THE RF. IF THE CHILD SAYS THAT HE OR SHE DOES NOT KNOW, CIRCLE THE DK.

DIRECTIONS: PLACE THE COUNTERS TO THE SIDE OF THE CHILD. PLACE SHEET “F” IN FRONT OF THE CHILD. IF THE CHILD DOES NOT RESPOND FOR AN ITEM, REPEAT THE QUESTION ONCE, WAIT THREE SECONDS AND MOVE ON TO THE NEXT ITEM. RECORD THE SCORES BELOW.

PRACTICE ITEM ONE:

SAY: **Now we are going to do some addition and subtraction problems.**

POINT TO THE COUNTERS AND SAY: **Here are some things you can use to answer these questions.**

POINT TO THE FIRST ADDITION PROBLEM ON SHEET F1 AND SAY: **How much is 1 and 2 altogether?**

IF THE CHILD CORRECTLY ANSWERS “3”, SAY: **That’s right, one and two altogether is three. Let’s do another one.**

IF THE CHILD DOES NOT CORRECTLY ANSWER, SAY: **The answer is three.** USE THE COUNTERS AND READ THE PROBLEM DEMONSTRATING BY PUSHING ONE COUNTER TO THE CHILD AND SAY: **This is one.** THEN PUSHING TWO COUNTERS TOWARD THE CHILD AND SAY: **This is two.** COUNT ALL THREE COUNTERS ALOUD AND SAY: **One and two altogether is three. Let’s do another one.**

Geometry: Shape Recognition

- Children bring a level of informal geometry skills such as perception of shape and space to school
- Formal schooling provides opportunities to build on existing knowledge as children:
 - Learn about their surroundings
 - Learn how to communicate their position in relation to these surroundings

Snapshot of Shape Recognition

TASK 8: SHAPE RECOGNITION

MATERIALS: SHEETS "G1" THROUGH "G4"

STOP RULE: N/A

SCORING: THE CORRECT SHAPES ARE MARKED WITH A PATTERN OF DOTS ON THEM. FOR EACH CORRECT SHAPE THE CHILD IDENTIFIES, HE OR SHE GETS A POINT. ENTER THE SCORE ON THE LINE THAT FOLLOWS EACH FIGURE.

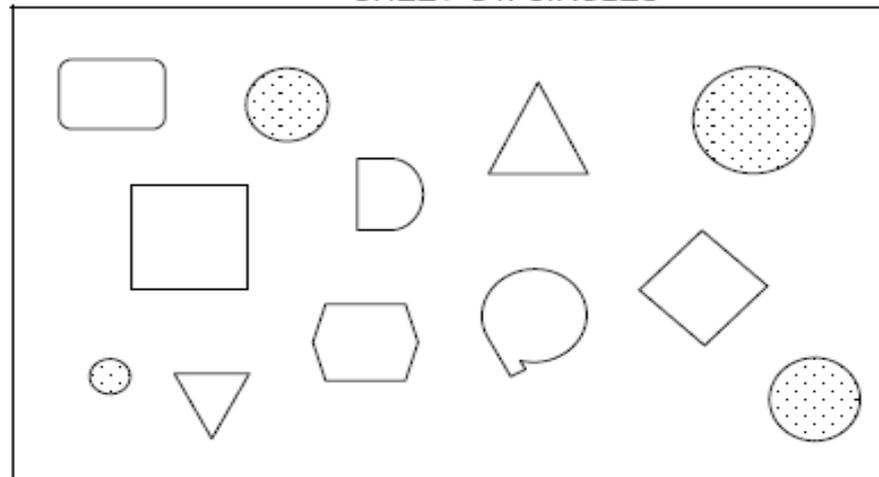
DIRECTIONS: FOR EACH OF THE SHAPES BELOW, ONCE THE CHILD FINISHES PLACING THE COUNTERS ON TOP OF THE SHAPE SHEET, MARK THE SHAPES WITH A "✓" ON YOUR SHEET. THEN, RECORD THE NUMBER OF SHAPES THAT WERE COUNTED CORRECTLY. MAKE SURE TO FOLLOW THESE INSTRUCTIONS FOR EACH SHAPE SHEET PRESENTED TO THE CHILD.

SAY: Now we are going to play another game with shapes.

PLACE THE COUNTERS TO THE SIDE OF THE CHILD.

POINT TO THE COUNTERS AND SAY: I want you to place the counters on all of the circles you find on this sheet. PLACE THE SHEET IN FRONT OF THE CHILD. Let me know when you are done.

SHEET G1: CIRCLES



Next Steps

Literature review

Draft development of items

Meeting with experts

Continued development of items

Identification of potential countries

Working with identified countries

Piloting the Instrument

- Working with Ministry of Education
- Train assessors
- Collect data
- Review and report data collected

Questions

THANK YOU!

For more detailed information go to:

www.eddataglobal.org