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# The Early Grade Math Assessment (EGMA)

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# About the presentation

- This presentation was prepared for USAID's Worldwide Education and Training Workshop, Arlington, Virginia, August 17-21, 2009. The workshop was organized by the Bureau for Economic Growth, Agriculture and Trade (EGAT/ED). The purpose was for "the international development community to share best practices in addressing the growing challenges in the field of education for social and economic development."
- The Early Grade Math Assessment (EGMA) described in this presentation was developed under the USAID EdData II project led by RTI International, Task Order 2, EHC-E-02-04-00004-00.

# Outline

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- Why Math?
- Why an EGMA?
- Essential Components
- EGMA Contents
- Examples of EGMA Tasks
- Current Activities

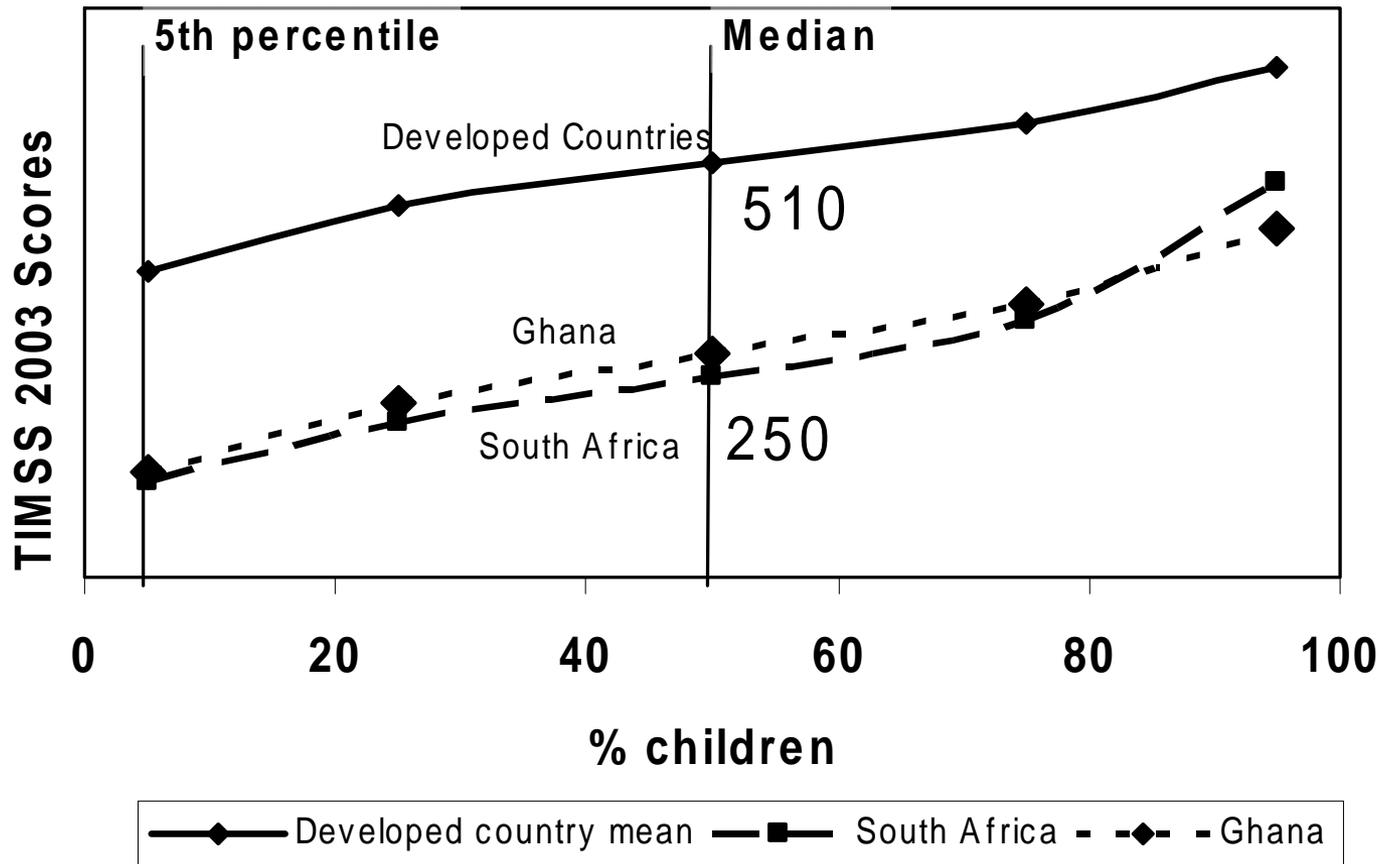
# Why Math?

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- 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



# Why an EGMA?

- Research on mathematics teachers in developed countries.
- Mathematically competent
  - Importance of skills taught to children
  - Sequence skills
  - Assess Skills

## 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 <sup>1</sup>	X <sup>1</sup>
Data Analysis/Data Handling	X	X	X	X
Algebra	X	X <sup>2</sup>	X <sup>3</sup>	X <sup>3</sup>

<sup>1</sup> In South Africa and Jamaica this is referred to as Shape & Space.

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

<sup>3</sup> 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"><li>▪ Whole numbers</li><li>▪ Counting, cardinality, comparison</li></ul>
Kindergarten	<ul style="list-style-type: none"><li>▪ Represent, compare, order whole numbers</li><li>▪ Join, separate sets of objects</li></ul>
First grade	<ul style="list-style-type: none"><li>▪ Understand addition, subtraction</li><li>▪ Strategies for basic addition, subtraction facts</li></ul>
Second grade	<ul style="list-style-type: none"><li>▪ Understand<ul style="list-style-type: none"><li>▪ Base-ten numeration</li><li>▪ Place-value concepts (fluency with multi-digit addition, subtraction)</li></ul></li></ul>

# 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 <sup>1</sup>	South Africa <sup>2</sup>	Jamaica	Botswana <sup>3</sup>
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

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

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

<sup>3</sup> Works with numbers up to 20.

# Essential Components: Geometry

## National Council of Teachers of Mathematics

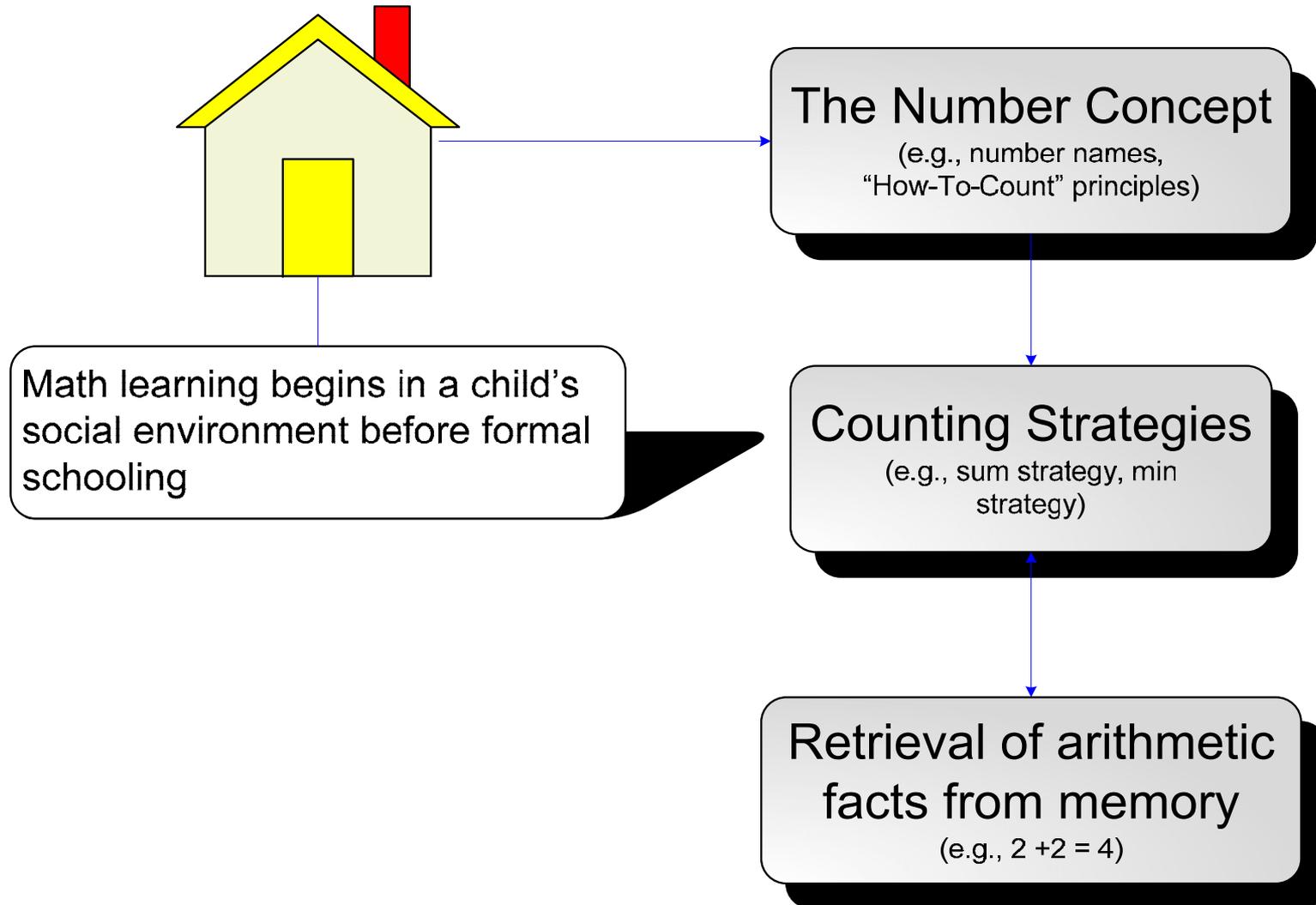
School Year	Overall Goals
Prekindergarten	<ul style="list-style-type: none"><li>Identify shapes</li><li>Describe spatial relationships</li></ul>
Kindergarten	<ul style="list-style-type: none"><li>Describe shapes, space</li></ul>
First grade	<ul style="list-style-type: none"><li>Compose, decompose geometric shapes</li></ul>
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 "A1"

**STOP RULE:** N/A

**DIRECTIONS:** PLACE SHEET "A1" 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 2: QUANTITY DISCRIMINATION MEASURE – PRACTICE

**MATERIALS:** SHEET "B1" AND COVERSHEET

**STOP RULE:** N/A

**SCORING:** N/A

**DIRECTIONS:** PLACE SHEET "B1" IN FRONT OF THE CHILD AND FOLLOW THE INSTRUCTIONS, BELOW.

P1. SAY: Look at these numbers. Tell me which one is bigger? Tell me the number name.

P1.	10	4	
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IF THE CHILD ANSWERS CORRECTLY SAY, "That's right, 10 is bigger". Let's do another one.

IF THE CHILD ANSWERS INCORRECTLY POINT AT 10 AND SAY, **this is ten**, POINT AT 4 AND SAY, **This is four**. POINT AT 10 AND SAY, **ten is bigger** POINT AT 4 AND SAY **than four**. Let's try another one.

P2. SAY: Look at these numbers. Tell me which one is bigger? Tell me the number name.

P2.	8	12	
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IF THE CHILD ANSWERS CORRECTLY SAY, "That's right, 12 is bigger". Let's do another one.

IF THE CHILD ANSWERS INCORRECTLY POINT AT 12 AND SAY, **this is twelve**, POINT AT 8 AND SAY, **This is eight**. POINT AT 12 AND SAY, **twelve is bigger** POINT AT 8 AND SAY **than eight**. Let's do some more.

# Number Line Estimation Task

- Estimations on a number line
  - Number Sense Awareness
  - Number Value
- Children will demonstrate
  - Understanding of where numbers are positioned on a number line
- Predictive power
  - Understanding of Number Sense
  - Later success with mathematics

# Snapshot of Number Line Estimation

## TASK 3: NUMBER LINE ESTIMATION – PRACTICE ITEM

**MATERIALS:** EGMA BOOKLET AND COVER SHEET    **STOP RULE:** THERE IS NO STOP RULE FOR THIS TASK.  
**SCORING:** N/A

**DIRECTIONS:** PLACE WORKBOOK WITH THE COVER SHEET ON TOP IN FRONT OF THE CHILD. SLIDE THE COVER SHEET DOWN WHEN YOU ARE READY TO BEGIN WITH THE PRACTICE ITEM.

PRACTICE ITEM 1: PULL THE COVER SHEET DOWN SO THE CHILD CAN SEE THE PRACTICE ITEM AND SAY:

**Now we are going to work with number lines. Numbers on a number line go from the smallest number to the largest number. I want you to show me about where you think the number goes on the number line. When you decide about where the number goes, I want you to make a line through the number line with this pencil for me. Let's try one together.**

POINT TO "0" AND SAY: **This number line goes from zero at this end**

POINT TO "99" AND SAY: **to one-hundred at this end.**

POINT TO THE NUMBER LINE FROM LEFT TO RIGHT AND SAY: **If this is zero and this is one-hundred,**

HAND THE CHILD THE PENCIL AND POINT TO THE NUMBER IN THE BOX DIRECTLY UNDER THE ITEM NUMBER AND SAY: **where would you put 10? Mark it for me.**

TAKE THE PENCIL BACK FROM THE CHILD AFTER THE NUMBER LINE HAS BEEN MARKED.

MAKE SURE THE CHILD MAKES A VISIBLE MARK THROUGH THE NUMBER LINE.

IF THE CHILD DOES NOT UNDERSTAND WHAT WE ARE ASKING HIM/HER TO DO AND IS HAVING DIFFICULTY WITH PLACING A LINE THROUGH THE NUMBER LINE. DEMONSTRATE THIS USING THE NUMBER LINE AND SAY: **Think of the number line as a long line of people. Some people are in the front of the line and some are in the back of the line. If I wanted to know where the 10<sup>th</sup> person in the line was, I would look toward the front of the line. So, here is the line of people. About where do you think the 10<sup>th</sup> person in the line is, show me.** ONCE THE CHILD SHOWS YOU, DEMONSTRATE HOW TO MARK THE NUMBER LINE WITH THE PENCIL.

MAKE SURE THE CHILD UNDERSTANDS THE TASK BEFORE MOVING ON.

ONCE FINISHED SAY: **Let's do some more.**

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# 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 change<sup>1</sup>
- Children who are able to do the previous skills, such as counting and quantity discrimination, will demonstrate some knowledge of these skills.

<sup>1</sup> 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 5: ADDITION/SUBTRACTION PROBLEMS – PRACTICE ITEMS

**MATERIALS:** SHEET "D1-PRACTICE"

**STOP RULE:** N/A

**SCORING:** N/A

**DIRECTIONS:** PLACE SHEET "D1-PRACTICE" IN FRONT OF THE CHILD AND BEGIN PRACTICE ITEM.

D1-PRACTICE: ADDITION PRACTICE ITEM:

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

POINT TO THE ADDITION PROBLEM ON THE SHEET AND SAY: **How much is one plus two altogether?**

(IF CHLD DOES NOT UNDERSTAND, SAY: **How much is one and two altogether?**)

IF THE CHILD CORRECTLY ANSWERS "3", SAY: **That's right, one plus two altogether is three. Let's do some more.**

IF THE CHILD DOES NOT CORRECTLY ANSWER, SAY: **The answer is three. One plus two altogether is three. Let's do some more.**

# 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 6: SHAPE RECOGNITION

**MATERIALS:** SHEETS "E1" THROUGH "E4" AND COUNTERS

**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.

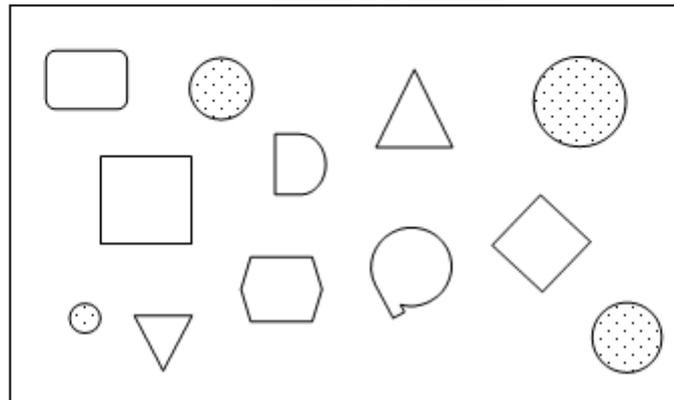
**DIRECTIONS:** FOR EACH OF THE SHAPES BELOW, ONCE THE CHILD FINISHES PLACING THE COUNTERS ON TOP OF THE SHAPE SHEET, MARK THE SHAPES WITH A SLASH "/" ON YOUR SHEET. THEN, RECORD THE NUMBER OF SHAPES THAT WERE COUNTED CORRECTLY. MAKE SURE TO FOLLOW THESE INSTRUCTIONS FOR EACH SHAPE SHEET PRESENTED TO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

**SAY:** Now we are going to work 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 E1: CIRCLES



# Current Activities

**Literature review**

**Draft development of items**

**Meeting with experts**

**Continued development of items**

**Identified and Pre-piloted of EGMA**

**Identification of potential countries**

**Working with identified countries**

THANK YOU!

For more detailed information go to:

[www.eddataglobal.org](http://www.eddataglobal.org)