Math for ALL & ELL: Together

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Why are we here:

- To Reach *EVERY* student: *ALL* and *ELL*
  - Differentiation
  - Communication, Language
  - Culture, Context
- I am a Teacher, Learner
  - ELL
- For Equity
Excellence in mathematics education rests on equity – high expectations, respect, understanding, and strong support for all students.

Equity:

• An equitable, high quality mathematics education for ALL students

By: supporting, linking, informing teachers

TODOS: Mathematics for ALL

www.todos-math.org
Key Points

- Each student is different
- Communication, languages
- Barriers, “accommodations”
- Differentiated Instruction
- Support ALL teachers, family, …
Each Student is Different

- Culture
- Ethnicity, race
- Language
- Family, SES
- Gender
- Religion
- Prior knowledge
- School
- Expectations
- Legal status
Each student is different:

– Family and their support
  • “ashamed” “exhausted”
  • “Miriam can be a bank teller”
  • “Frank will go to university…”
  • “What is “college” ”

– Other support
Equity

Assessments

*Significantly different (p < .05) from 2009.

NOTE: The NAEP Mathematics scale ranges from 0 to 500. Some apparent differences between estimates may not be statistically significant.

Scores by Race & Ethnicity

Percentages at or above each achievement level for mathematics, grade 8 by race/ethnicity using 2011 guidelines, school-reported for year and jurisdiction: 2011 2011, National

Note: Black includes African American, and Hispanic includes Latino. Race categories exclude Hispanic origin. Some apparent differences between estimates may not be statistically significant.


**Economic Disparity!**

**Grade 8, 2003-2011**

*Significantly different* (p < .05) from 2011.

NOTE: The NAEP Mathematics scale ranges from 0 to 500. Some apparent differences between estimates may not be statistically significant.

Poverty and PISA

• U.S. students in schools with 10% or less poverty are number 1 in the world

• U.S. students in schools with 25-50% poverty are number 10 in the world

• U.S. students in schools with greater than 50% poverty are near the bottom
2331 dropouts already TODAY

1 student every 26 seconds

America's Promise Alliance

To help communities implement solutions to the high school dropout crisis
Assessments tell us

Your students may not do well IF

- They are poor
- They are ELLs
- They are NOT Asian nor White
The Problem:

Math, Language & Culture

2014

$10^9$ vs. $10^{12}$
Is The Math Different?

- Billions, trillions
- Comma, Decimal pt. $3,14$ or $3.14$
- Symbols $7$ vs $7$
- Division, subtraction
- Measurement, money
- Instruction, expectations
Other differences:

• Instruction and expectations - culture
• Different algorithms, models
• “Stand and Deliver” vs. “Communicative”
• Curriculum – sequence, scope
• “…the children are not broken they just don’t speak English.”

...the fundamental notion is not that ...they need mathematics different from ...“majority” students but rather ...that effective instruction for all must be carried out on the basis of what is known about how all students learn with understanding.

My favorite number is 24 because it’s Jeff Gordon’s car number and because it’s even and it’s more than 23.

Travis Smith
Mathematics and Language

- Social, Academic, Math
  - read, written, spoken, heard
  - Manipulatives, Drawings
  - Models, symbols, graphs
  - Words, phrases, sentences
  - Problems:
    - Interpret, Represent, Solve
    - Explain - Justify
Develop Language
The **barriers of** Language for **ALL** learners

- Right (geometry)
- Right (direction)
- Right (Correct)
- Right here
- Right now
- Right track
- Civil right
- Write
- Wright
- Rite
- Riot
Developing Math Language: Describe
Make Connections
Flag of Argentina

• It has 3 horizontal stripes.
• Two stripes are blue.
• The middle one is white.
• It has a sun in the center.
Developing Math Language
Hexagon

Hexagon

Hexahedron

Hexagram
tessellations

Science

Art
Hexagonal Lighthouses - 19th century

Neuse River lighthouse
Drawing is based on Coast Guard photo

Carolina Kate, the mascot for Carolina Kids, is an extinct Carolina parakeet.

Elizabeth City
Albemarle Sound
Kill Devil Hills
Roanoke Island
Ocracoke
Portsmouth Island
Cape Lookout
Core Banks
Hatteras
Cape Hatteras
Hatteras Island
Ocracoke Island
Carolina Sound
Pamlico Sound
ATLANTIC OCEAN
N.C.
Language

Strategy: Assess to Teach

- Prior knowledge
- Language
- Level of fluency
- Student confidence
Vocabulary

- Half \((\frac{1}{4}, 25\%, 0.5)\)
- Equal parts
- Parallel
- Intersect
- Right angle
- Perpendicular
- Square
- Triangle
- Parallelogram

- Perimeter
- Area
- Length
- Distance
- Same, longer, shorter
- Figure
- Shape
- Bisect
- Congruent
Explore with figures

Paper fold, describe
• *To enable (students) …*  
  to achieve in mathematics …  
  the teacher must help them develop language skills that go beyond mere social fluency

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6 cats, 2 groups

3 cats in each

6 ÷ 2
6 divided by 2
Organizer

Angle

90°
Organizer

4 sides

parallel
Patterns - Equations

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NCTM Position:

• ...communication "as an essential part of mathematics and mathematics education."

• ... all students, and ELL in particular, need to have opportunities and be given ... support for speaking, writing, reading and listening in math. classes.

*Principles and Standards* (2000), NCTM
Strategy: Math as a Language

Represent mathematically!
Math Language

• Use their own language:
  • Multiply - Multiplicar
  • Divide - Dividir
  • Sum – Suma
  • Punto, angulo,
  • Geometria, Algebra, …

• $2x + 5 = 27$ MATH LANGUAGE
With partner:

- My number is two less
- I have two left
- My number is twice as much
- ___ is three more than ___
Make up the problem

Kim has 2 dimes, 3 nickels, 1 penny

The answer is _______

36  6  4  1   no

What is the question? Explain
Represent:

One inch of rain is equivalent to ten inches of snow

\[ r = 0.10 \text{ s} \quad s = 10 \times r \]
One inch of rain is equivalent to ten inches of snow.

Rain to snow  
1:10 or 1/10 or 0.1

Snow to rain  
10:1 or 10/1

Amount of snow:  
10 times of the amount of rain

Amount of rain:  
10% of the amount of snow
The essence of teaching mathematics is to ask the right questions ...

to lead to other questions, discussions, conjectures ...

and to learning
Math *from* and *for* the real world:

Why did they make Lombard street Crooked??
Model with Mathematics

- Why is the road crooked?
Why is the Road Crooked?

If we cannot change the height, stretch the horizontal!

\( \frac{dy}{dx} \)
Making Lombard St. less steep

- How steep
- How much you go up as you go across
- Rate of change
- \( \frac{(y_1 - y_2)}{(x_1 - x_2)} \)
- Slope
- \( \frac{dy}{dx} \)
- \( f''(x) \)
Why is the staircase spiraling?

Making sense with MATH
Hospital Error Involved A Few Decimal Points

By KAREN GARLOCH
Staff Writer

A few misplaced decimal points caused Martha Alice Covert’s death.

Her death, which became public this week, is the third attributed to mistakes at Charlotte Memorial Hospital’s pharmacy since early 1988.

Covert, 69, of Concord died June 13 at Memorial after she received a hydrochloric acid solution that was more than 10 times stronger than her doctor ordered.

Hospital pharmacists mixed the solution incorrectly. They were confused by a handwritten note on the container of hydrochloric acid that contradicted the manufacturer’s label.

The N.C. Board of Pharmacy this week charged the hospital pharmacy and its former director, Wayne Rinehart, with negligence in Covert’s death.

In its notice of the charges, the board charged Memorial’s pharmacy with not having a standard method for noting changes in labeling stock containers. The board also charged the pharmacy with not having a system for periodically reviewing recipe cards on file for mixing intravenous solutions.

The notice, issued Wednesday, tells more about the mix-up than hospital officials previously revealed.

Asked about Covert’s death, Memorial has limited its response to one written statement. It said the patient was transferred June 12 to Memorial from Cabarrus Memorial Hospital, after emergency surgery for a ruptured abdominal artery. She was suffering from kidney failure. Doctors ordered the hydrochloric acid solution to correct an acid-base imbal-

See PHARMACY Page 4A
**Strategy:**
What is the problem

Draw a design

Questions:
- Length, width
- Area, Perimeter
- Parts in each color
- Other?
The problem with WORDS in Math
Strategy: P.S. No numbers

• Alex buys ____ tickets for the game.

• Tickets cost ______ each.

• Alex has ______ dollars.

• How much money does he have left after buying the tickets?
• Alex buys ___ tickets for the game.
• Tickets cost _____ each.
• Alex has ______.
• How much money does he have left after buying the tickets?

60  4  10  20
• Alex buys ___ tickets for the game.
• Tickets cost ______ each.
• Alex has ______ .
• How much money does he have left after buying the tickets?

5  28
Super Bowl 2014 tickets

- $2,000.00 per person: travel, tickets
- Hotel, food: $300/day extra

Write your problem. Solve

How much does it cost for one person to go?

Cost = 2000 + 300 \times \text{days}
Strategy: Tiered Lesson

- 3 or more Tiers
- Center, instructions for each Tier
- Students work in small groups
- Each student goes through all Tiers
- At their own pace

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Strategy: Tiered Lesson
Tier 1: Design, Solve

• Design a bracelet using colored chips
• Use the table to determine the cost of your bracelet

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• A bracelet has 3 orange beads, 2 yellow, and 2 light green.

• The number of dark green is one less that the number of yellow.

• How much does the bracelet cost?
Tier 3

- Create a $25.00 necklace.
- Describe and explain the cost.
- What is the maximum cost?
- How much is it worth?

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Equity does not mean that every student should receive identical instruction; instead, it demands that reasonable and appropriate accommodations be made as needed to promote access and attainment for all students.

PSSM, NCTM (2000)
Predictors of Success

- Support for teacher, students, school
- Support from all: community, family, *the village*
- High Expectations
- Prior academic achievement
- Careful planning for differentiated instruction
- Seamless approach to content and assessment
- Creative teaching, grouping and outreach programs

Equity Principle, *Principles to ACTION*, NCTM, 2014
PSSM, NCTM, 2000
Equity and Excellence

Equity *without* excellence is useless.

Excellence *without* equity is unjust.
We don’t teach mathematics; we teach students who come to us with diverse academic backgrounds, cultures, and languages—even if they were born in the United States.
Go to the children
teach them...

Thomas Aquinas