Math for ALL & ELL: Together

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Why are we here:

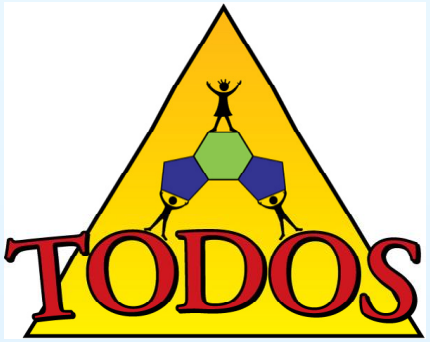
- To Reach *EVERY* student: ALL and ELL
  - Differentiation
  - Communication, Language
  - Culture, Context
- I am a Teacher, Learner
  - ELL
  - For Equity

NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS

Excellence in mathematics education rests on equity – high expectations, respect, understanding, and strong support for all students.

Position Paper: Equity in Mathematics Education, NCTM (2008)

Equity:



- **An equitable, high quality mathematics education for *ALL* students**

By: *supporting, linking, informing teachers*

TODOS: Mathematics for ALL

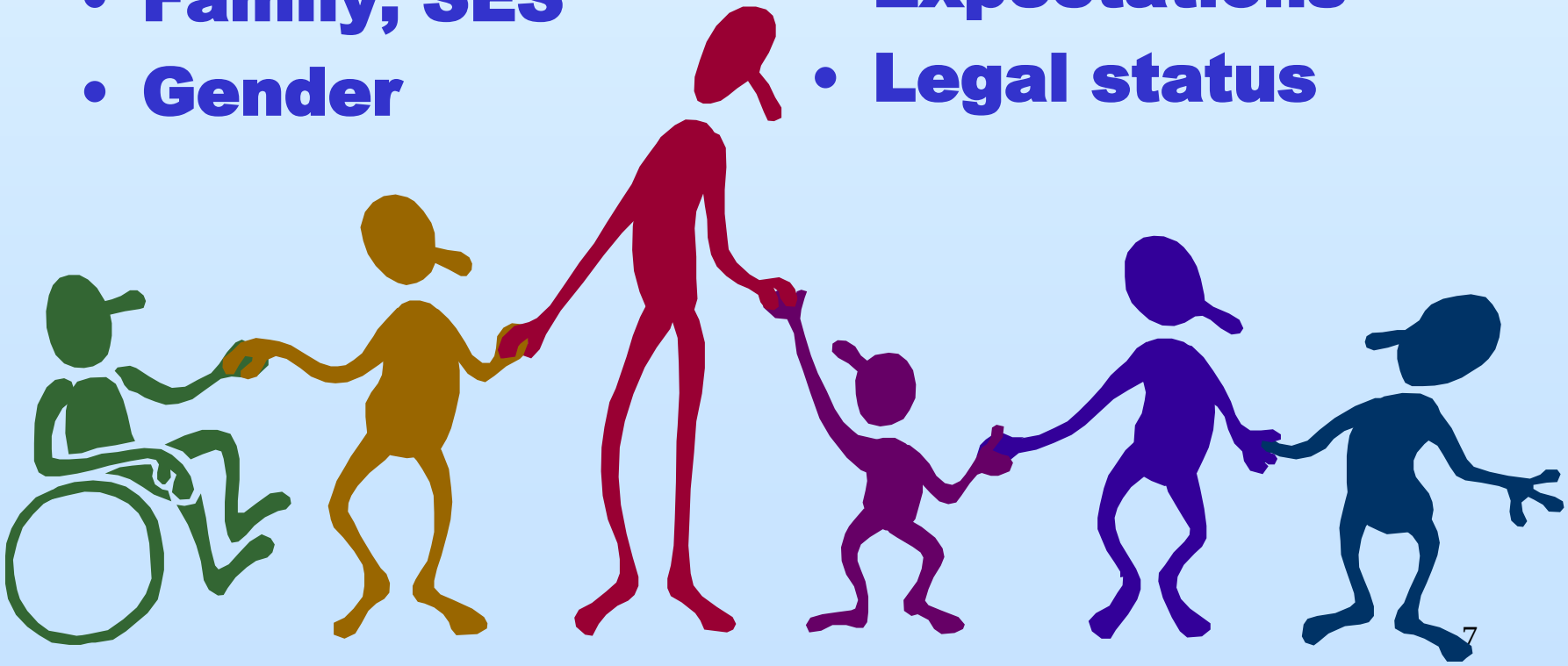
www.todos-math.org

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

Gap

Scores by race/ethnicity 1990 to 2011

△ White ○ Black ✚ Hispanic

◇ Asian/Pacific Islander ‡ □ American Indian/Alaska Native ‡ ☆ Two or more races ‡

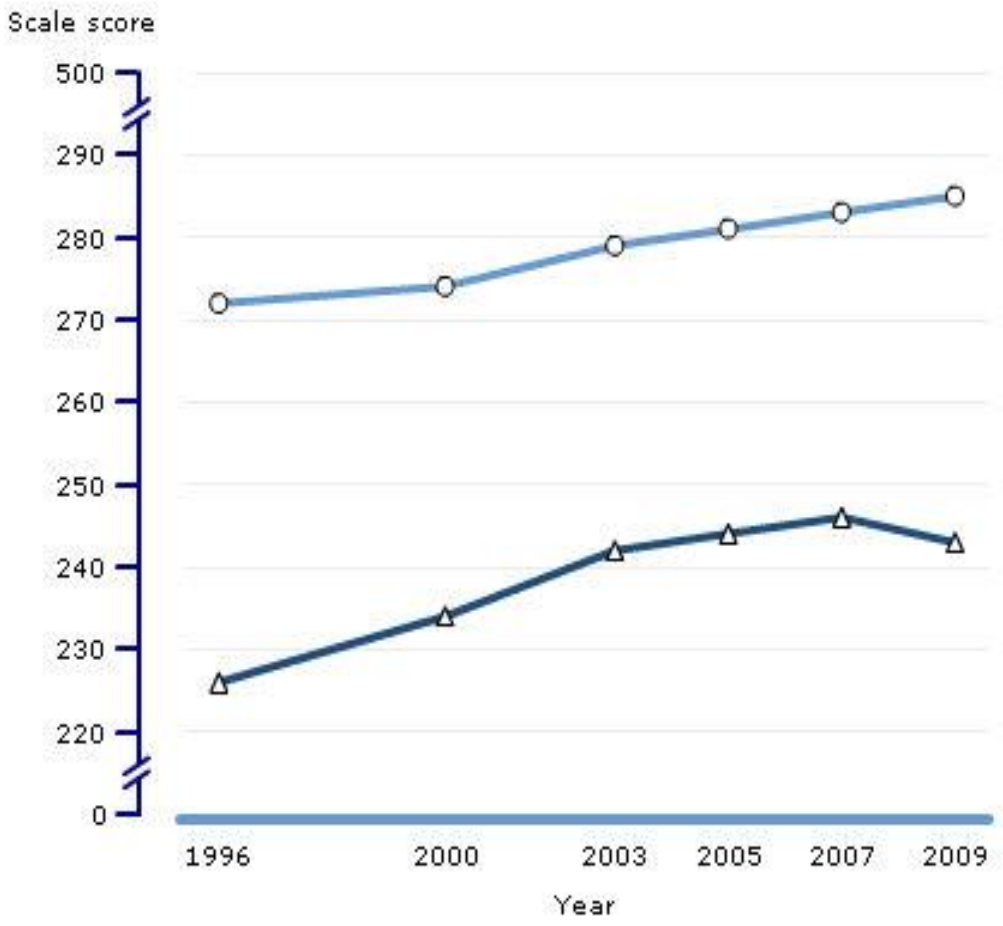
Accommodations not permitted.

Accommodations permitted.

‡ Data points that do not meet reporting standards are not displayed.

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

Average scale scores for mathematics, grade 8, by Student is English Language Learner (2 categories) [LEP] for jurisdiction: 1996, 2000, 2003, 2005, 2007, and 2009
National



NAEP, 2009

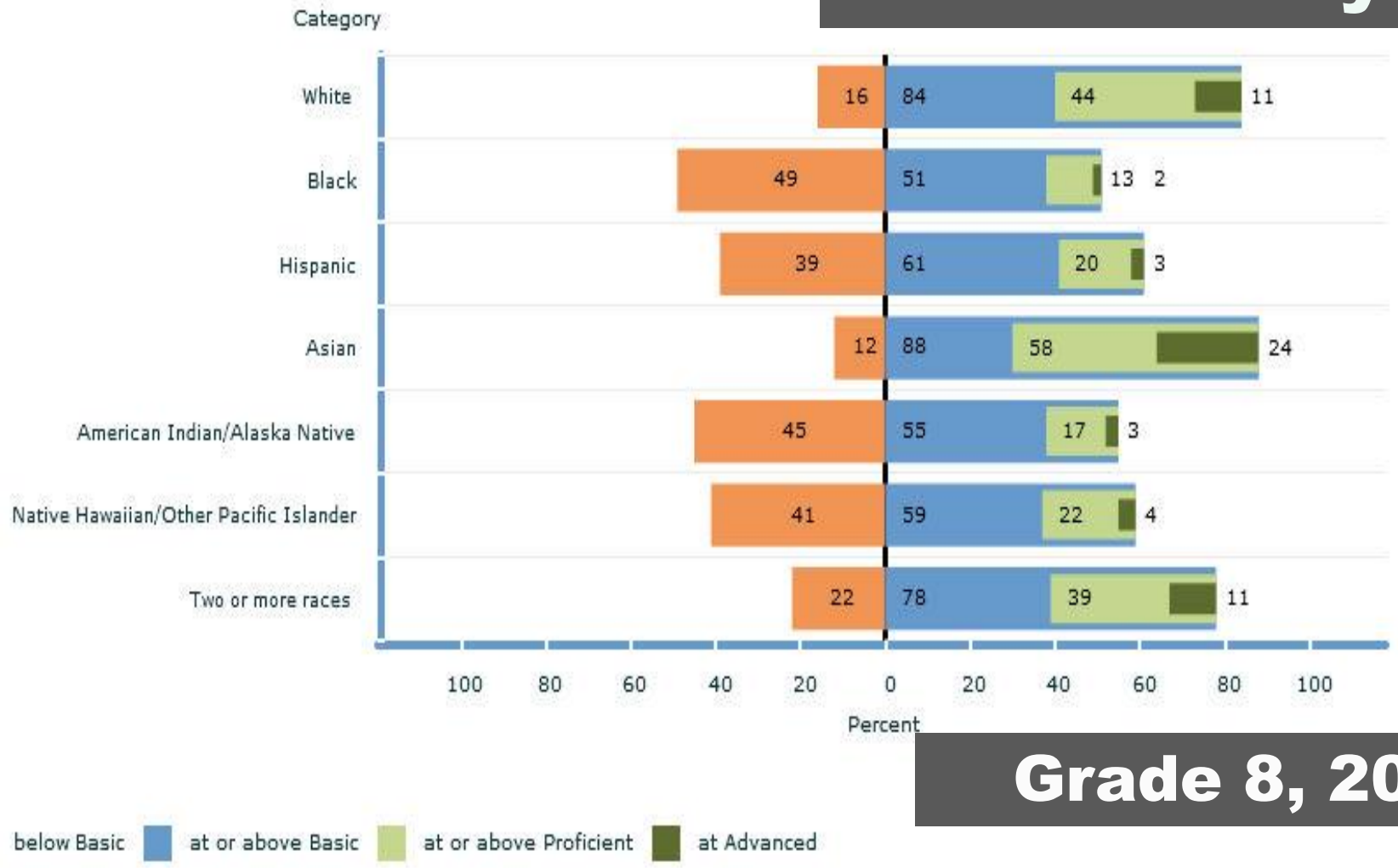
Math Gr.8,

Not ELL vs. ELL

* 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.
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educat
1996, 2000, 2003, 2005, 2007, and 2009 Mathematics Assessments.

Scores by Race & Ethnicity

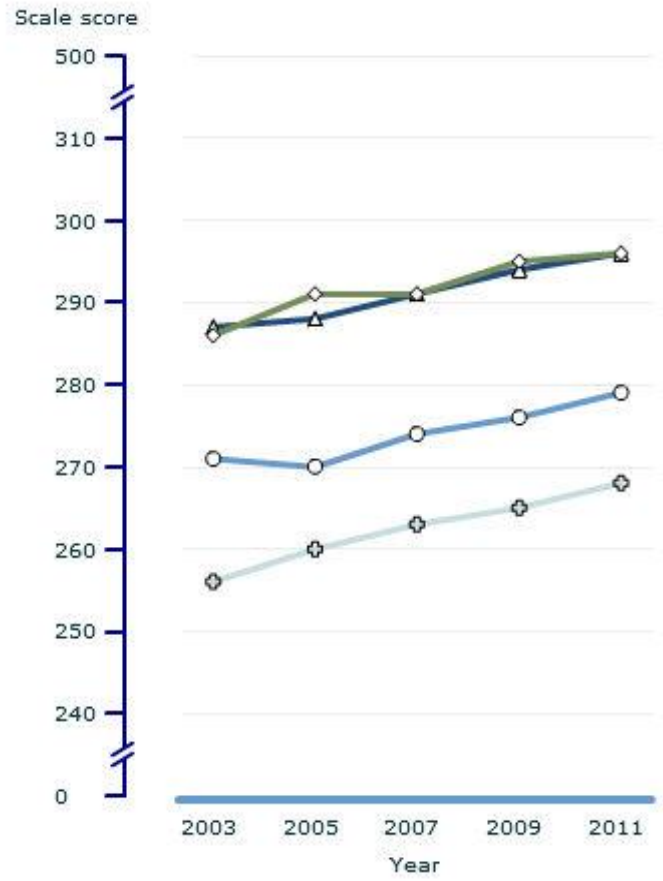
Percentages at or above each achievement level for mathematics, grade 8 by race/ethnicity using 2011 guidelines, school-reported for year and jurisdiction: 2011
2011, National



Grade 8, 2011

NOTE: Black includes African American, and Hispanic includes Latino. Race categories exclude Hispanic origin. Some apparent differences between estimates may not be statistically significant.
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2011 Mathematics Assessment.

Average scale scores for mathematics, grade 8 by National School Lunch Program eligibility, 6 categories (collapsed) for year and jurisdiction: 2003, 2005, 2007, 2009, and 2011
National



△ Not eligible ○ Reduced-price lunch ✣ Free lunch

◇ No info/Not participating (collapsed)

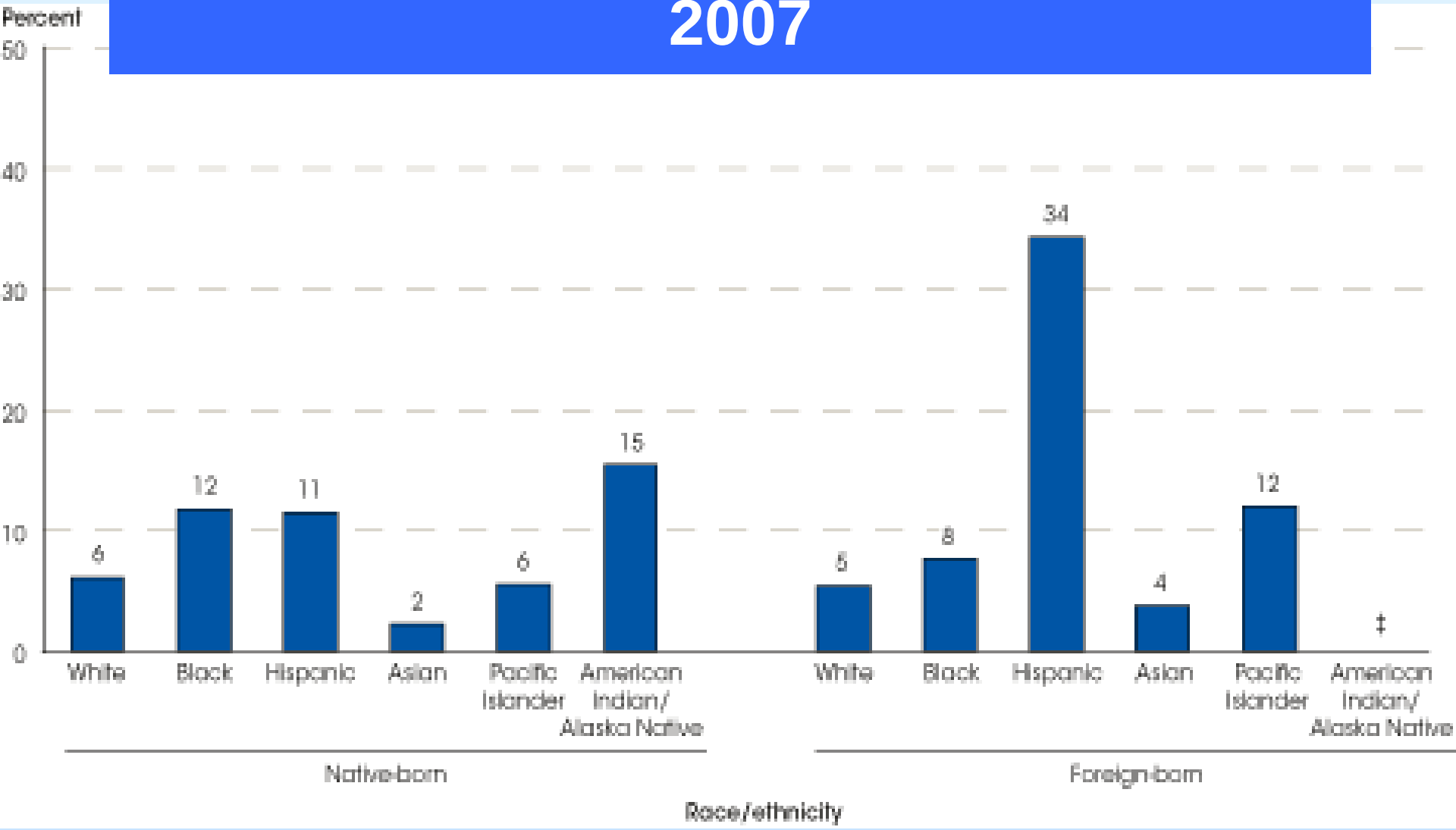
Economic Disparity! Grade 8, 2003-2011

* 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.
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 2003, 2005, 2007, 2009 and 2011 Mathematics Assessments.

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**

Dropout rates by race/ethnicity and nativity: American Community Survey 2007



NCES, 2009. The Condition of Education

2331 dropouts already **TODAY**

1 student every 26 seconds

AMERICA'S PROMISE ALLIANCE

To help communities implement solutions to the high school dropout crisis

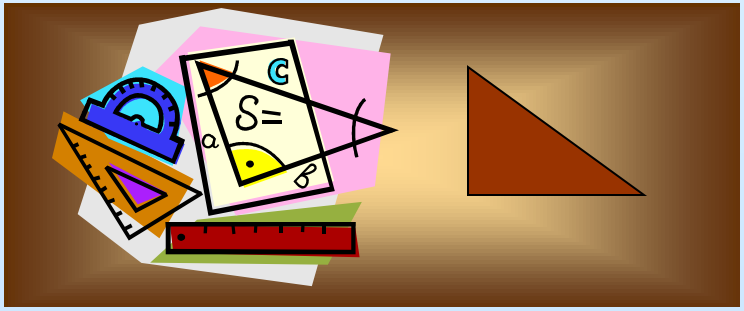
Assessments tell us

Your students **may not do well IF**

- **They are poor**
- **They are ELLs**
- **They are NOT Asian nor White**

2014

10^9 vs. 10^{12}



The Problem:

Math, Language & Culture

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."***

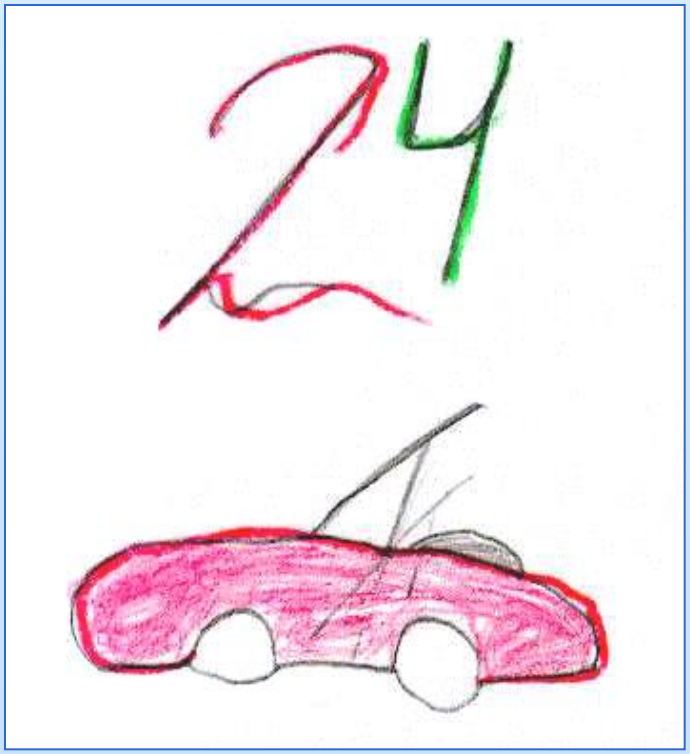
Noticias de TODOS,Vol. 3, No. 2, 2007

…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.

Hernandez, *The Mathematics Bilingual Education Connection*. Perspectives on Latinos, NCTM (1999)

Different Cultures

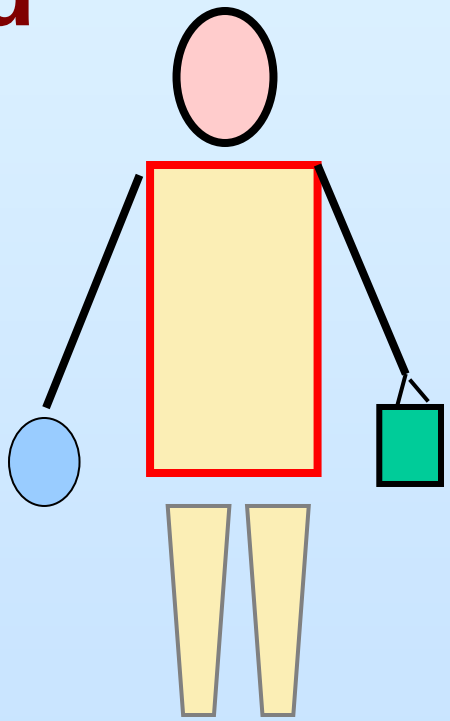
My favorite number is 24 because it's Jeff Gordon's car number and because it's even and it's more than 23.



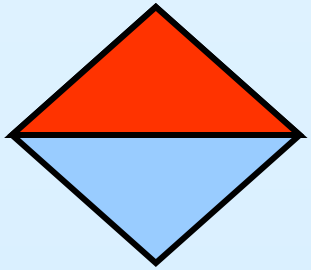
Travis Smith

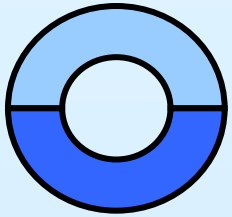
Mathematics and Language

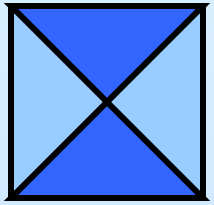
- **Social, Academic, Math**
  - **read, written, spoken, heard**
    - **Manipulatives, Drawings**
    - **Models, symbols, graphs**
    - **Words, phrases, sentences**
    - **Problems:**
      - **Interpret, Represent, Solve**
      - **Explain - Justify**

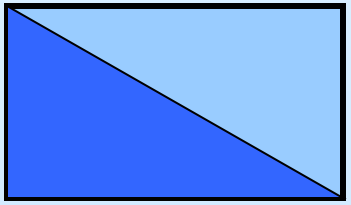


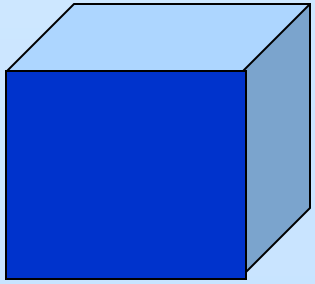
Develop Language





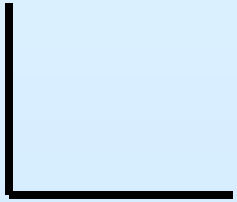






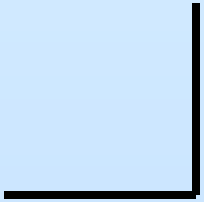
The *barriers of* Language for ALL learners

- **Right (geometry)**
- **Right (direction)**
- **Right (Correct)**
- **Right here**
- **Right now**
- **Right track**
- **Civil right**
- **Write**
- **Wright**
- **Rite**
- **Riot**



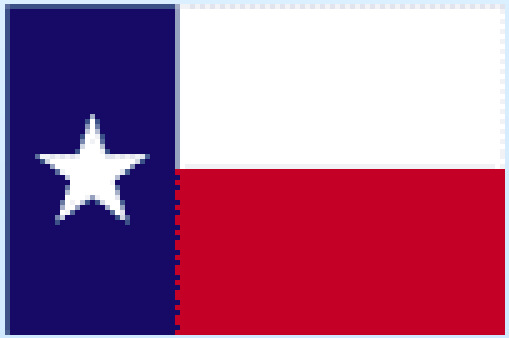
Right angle

Left angle



Developing Math Language: Describe

1



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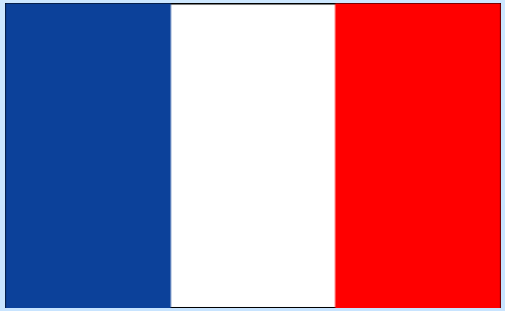


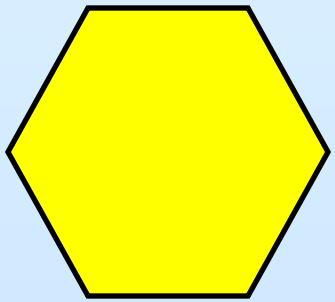
3

4

Make Connections
Flag of Argentina

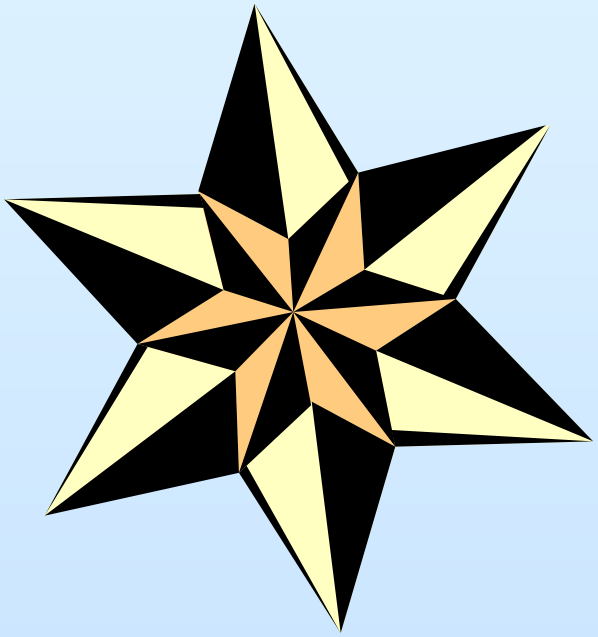
- It has 3 horizontal stripes.
- Two stripes are blue.
- The middle one is white.
- It has a sun in the center.

Developing Math Language
Hexagon

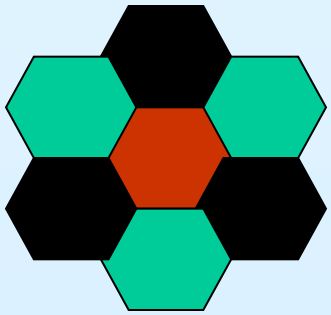


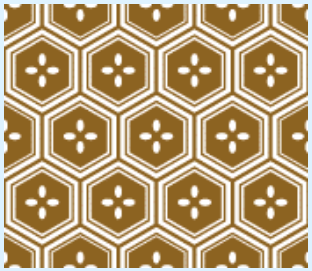
Hexagon

Hexahedron

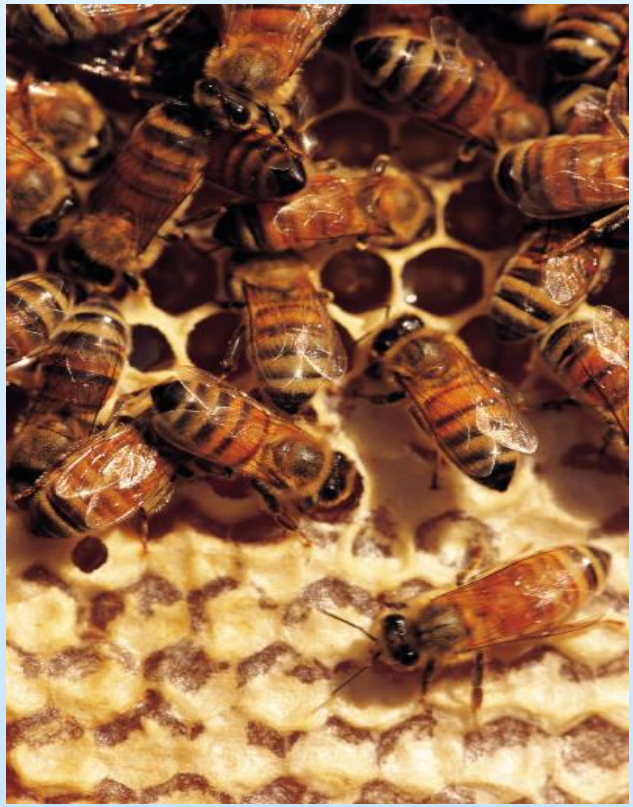


Hexagram





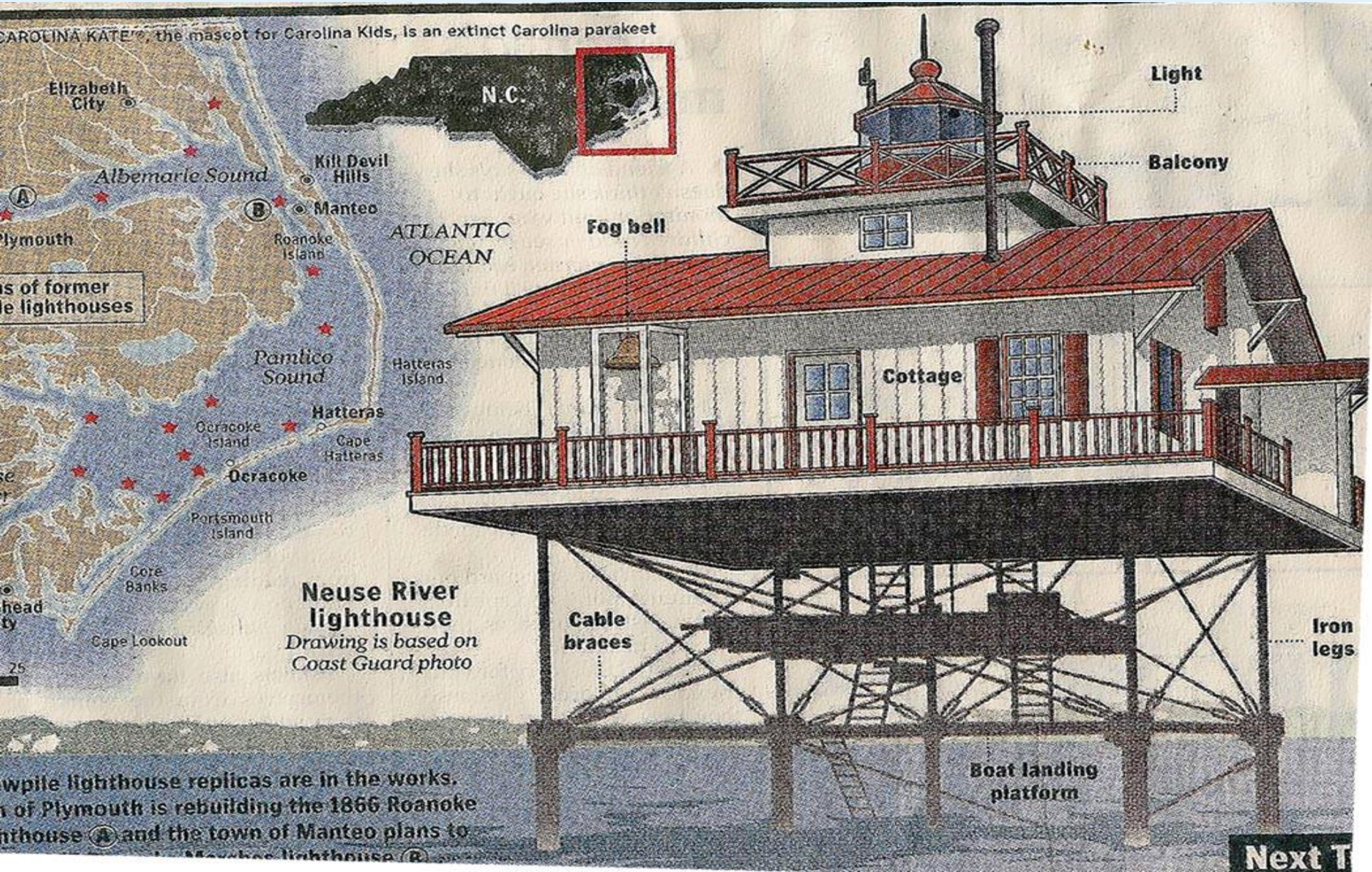
tessellations



Science

Art

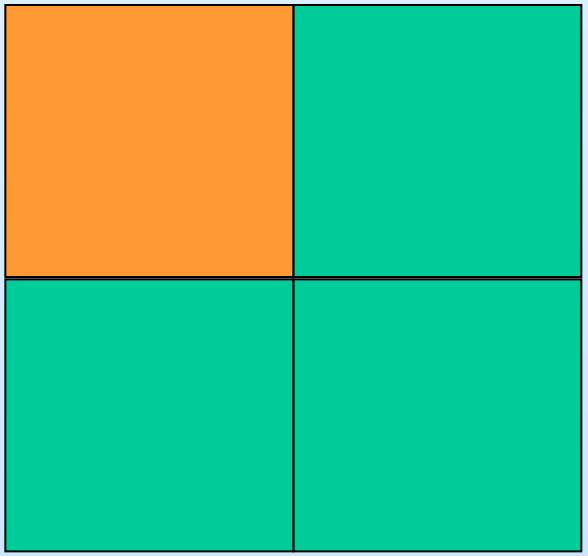
Hexagonal Lighthouses - 19th century



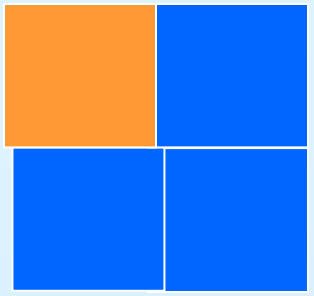
Language

Strategy: Assess to Teach

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



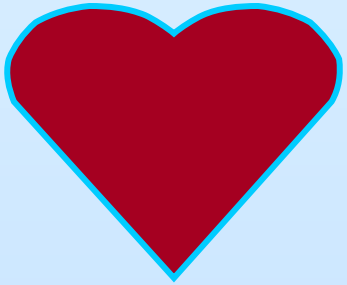
Vocabulary

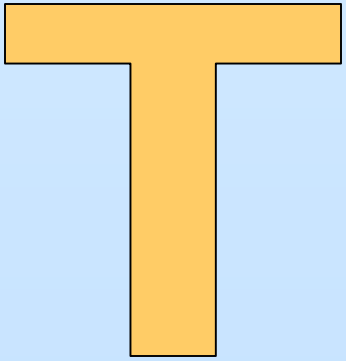


- **Half (¼, 25%, 0.5)**
- **Equal parts**
- **Parallel**
- **Intersect**
- **Right angle**
- **Perpendicular**
- **Square**
- **Triangle**
- **Parallelogram**
- **Perimeter**
- **Area**
- **Length**
- **Distance**
- **Same, longer, shorter**
- **Figure**
- **Shape**
- **Bisect**
- **Congruent**

Explore with figures

Paper fold, describe





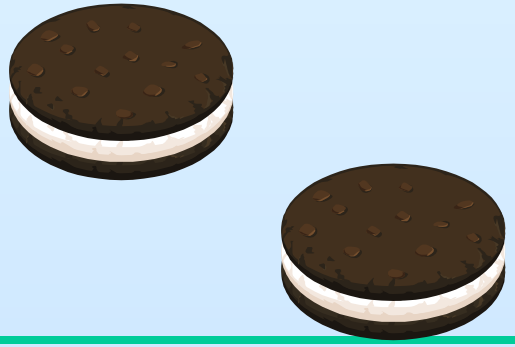
- ***To enable (students) …***

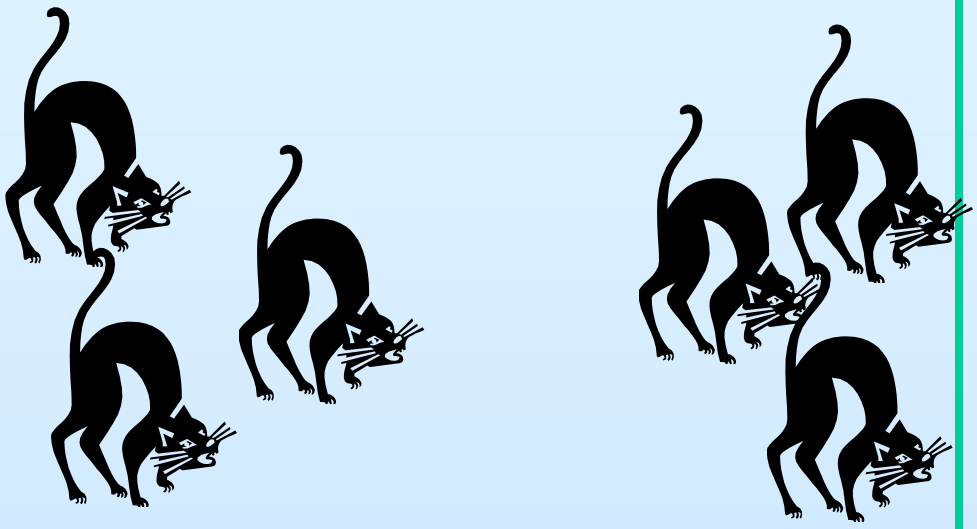
  to achieve in mathematics …

  the teacher must help them develop language skills that go beyond mere social fluency

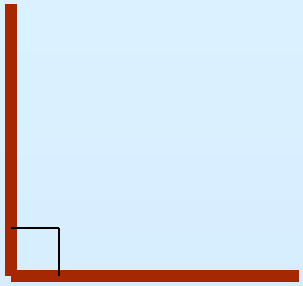
Peixotto. ***Teaching Mathematics and Science to English-Language Learners*****, NWREL (2002)**

Concept & Language Organizer

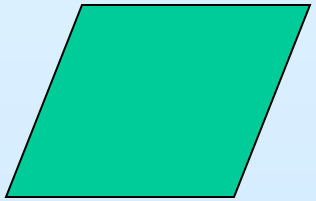
	2
1 + 1	TWO

6 cats, 2 groups	
3 cats in each	6 ÷ 2 6 divided by 2

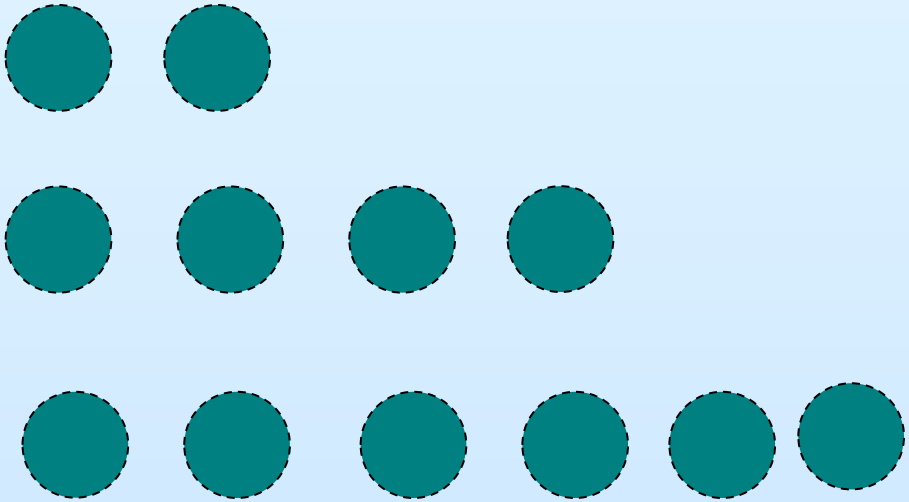
Organizer

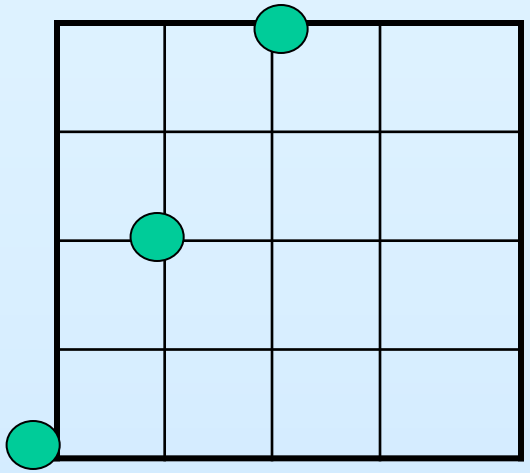
	**Angle**
90^{o}	

Organizer

	**4 sides**
parallel	

Patterns – Equations





X	Y
0	0
1	2
2	4
3	6

X	0	1	2	3
Y	0	2	4	6

NCTM Position:

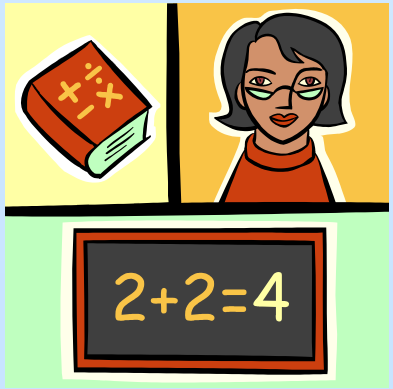
- **…communication "as an essential part of mathematics and mathematics education."**

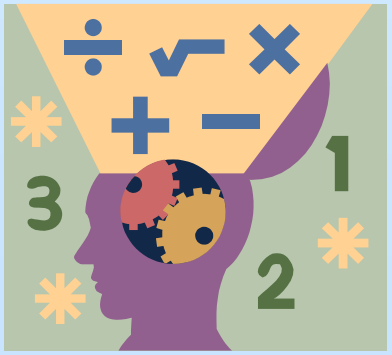
- **… all students, and ELL in particular, need to have opportunities and be given … support for speaking, writing, reading and listening in math. classes.**

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**

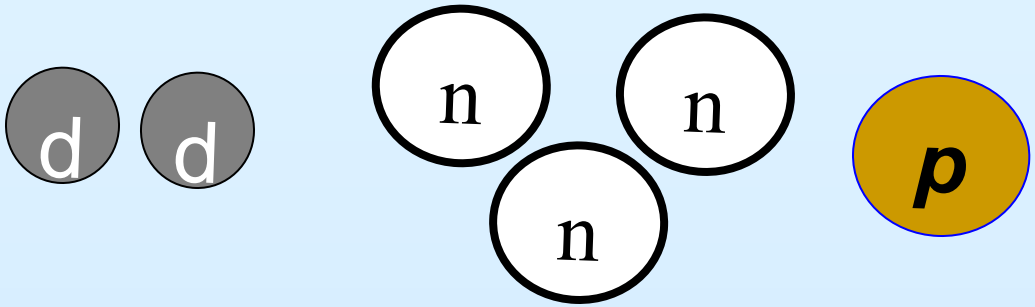
Language: words, phrases, sentences

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	28	30

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 _____

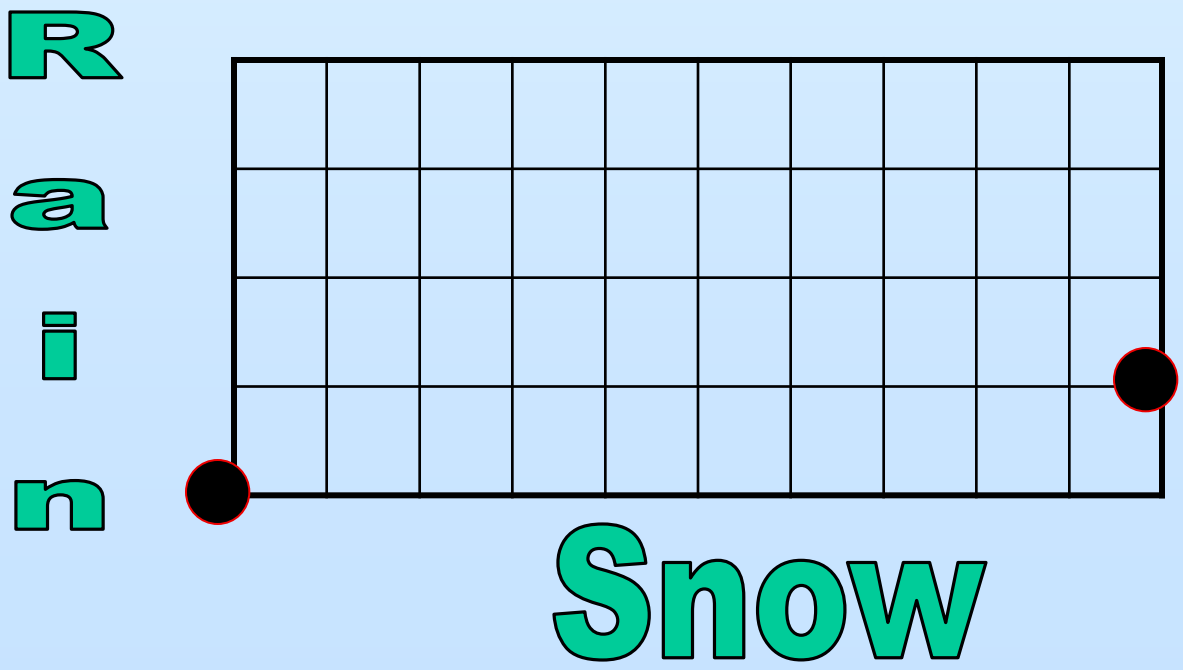
36 6 4 1 no

What is the question? Explain

Represent:

One inch of rain is equivalent to ten inches of snow

r = 0.10 s **s = 10 x r**



Represent

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 …

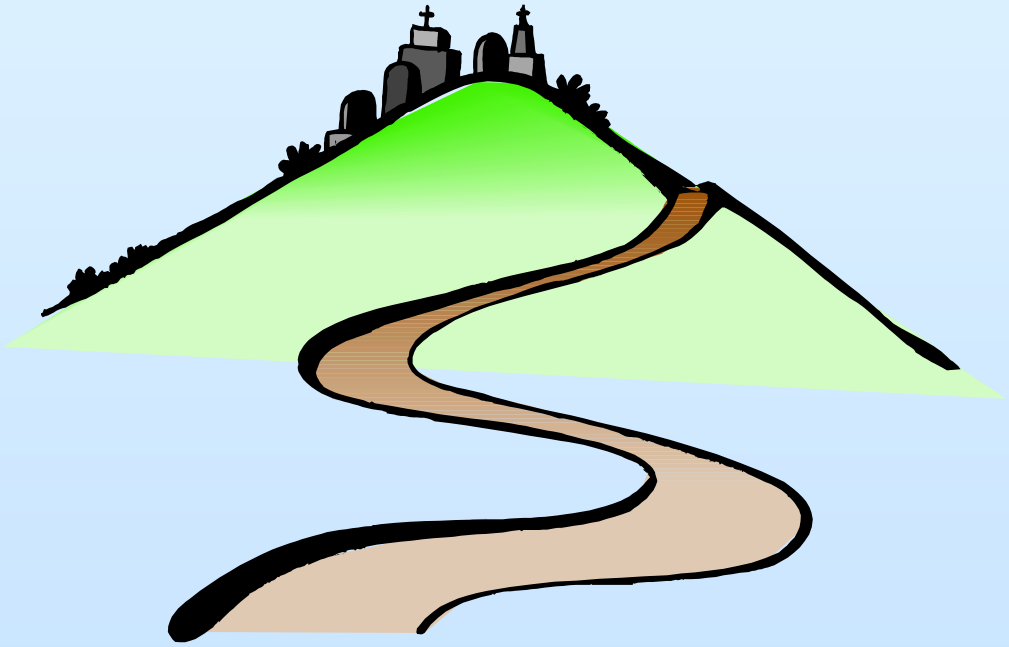
to lead to other questions, discussions, conjectures …

and to learning

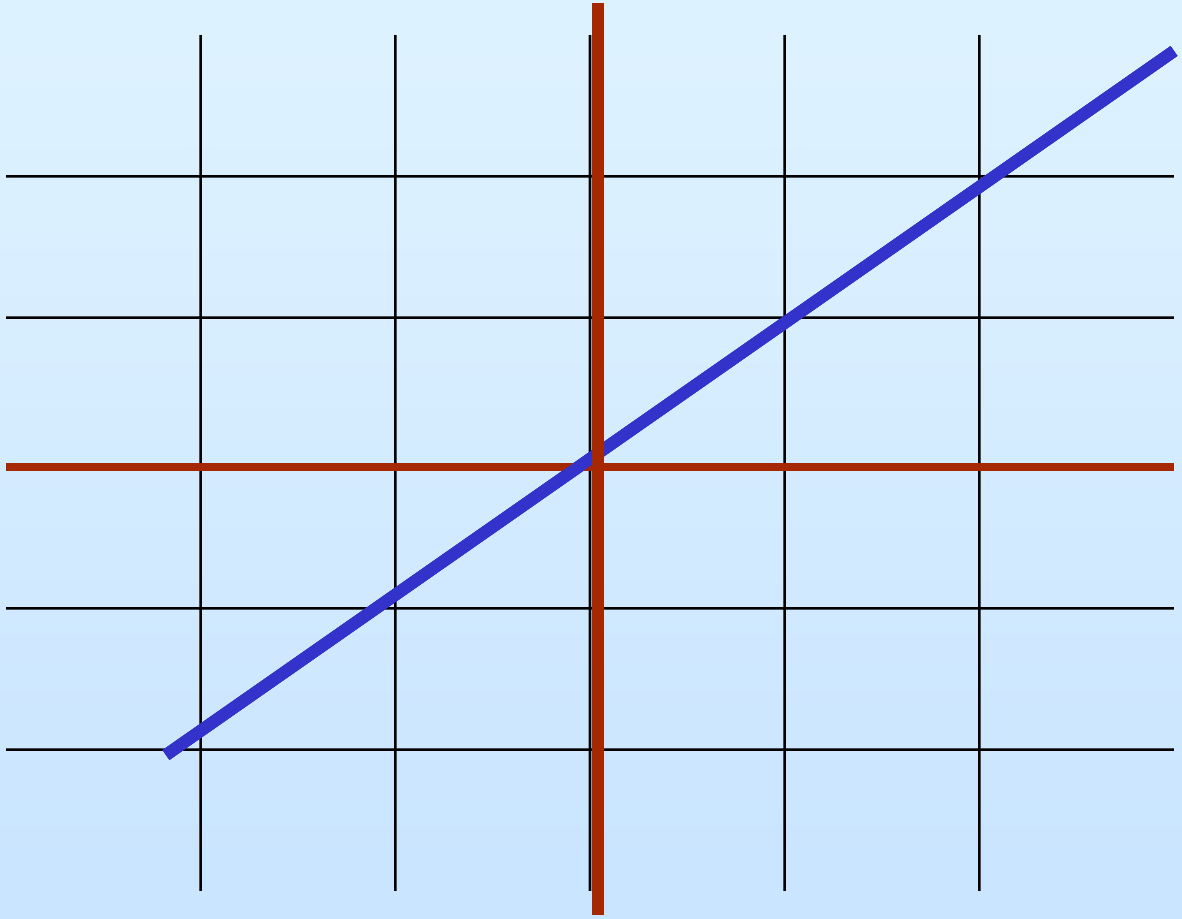
Math *from* and *for* the real world:

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!

dy/dx

Making Lombard St. less steep

- How steep
- How much you go up as you go across
- Rate of change
- $(y_1 - y_2)/(x_1 - x_2)$
- Slope
- dy/dx
- f'’(x)

Making sense
with
MATH

Why is the staircase spiraling?

Math In the Real World

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.

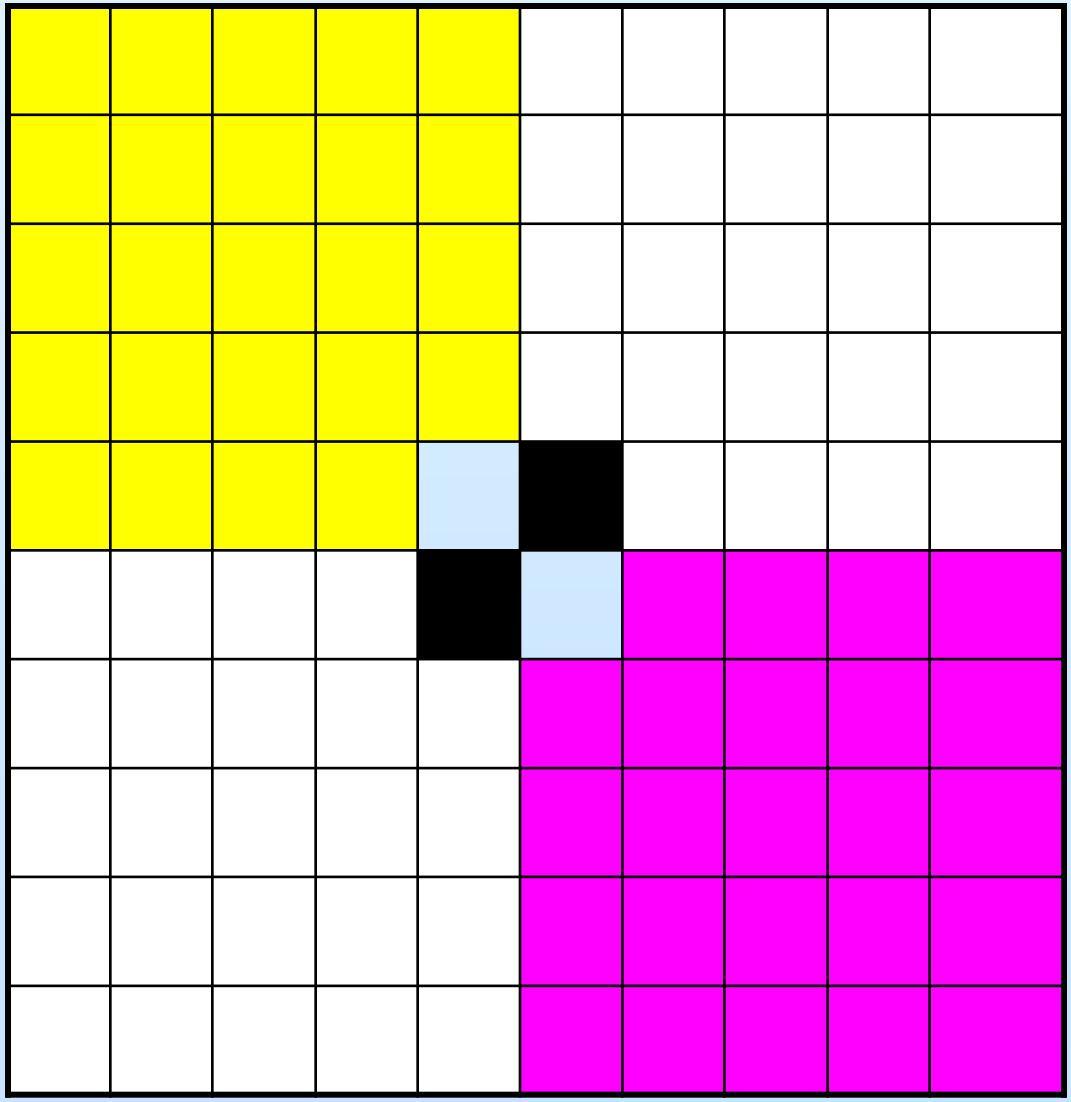
The notice, issued Wednesday, tells more about the mix-up than hospital officials previously revealed.

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

10 times stronger dosage of Hydrochloric Acid Solution than prescribed

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.**
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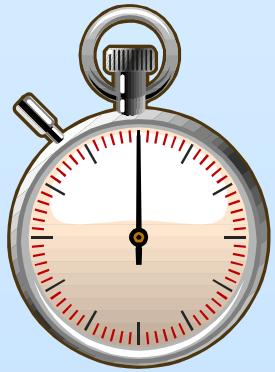
- **Alex has _____ .**
- **How much money does he have left after buying the tickets?**



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- **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

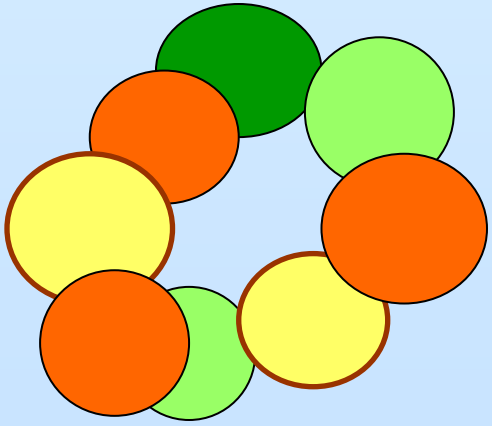
- **$2,000.00 per person: travel, tickets**
- **Hotel, food: $300/day extra**
- **Write your problem. Solve**

How much does it cost for one person to go?

Cost = 2000 + 300 x 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

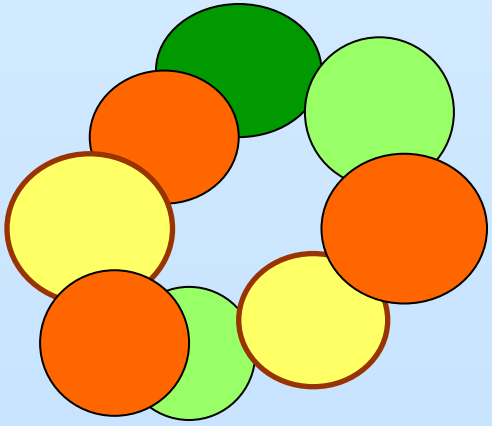


$3	$6	$4	$5

Strategy: Tiered Lesson
Tier 1: Design, Solve

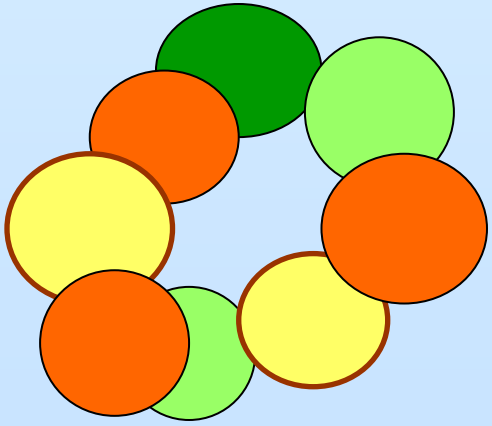
- **Design a bracelet using colored chips**
- **Use the table to determine the cost of your bracelet**

$3	$6	$4	$5



Tier 2: Write, Solve Problem

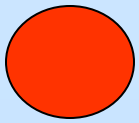
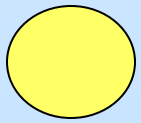
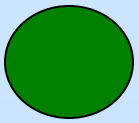
- **A bracelet has 3 orange beads, 2 yellow, and 2 light green.**
- **The number of dark green is one less that the number of yellow.**
- **How much does the bracelet cost?**

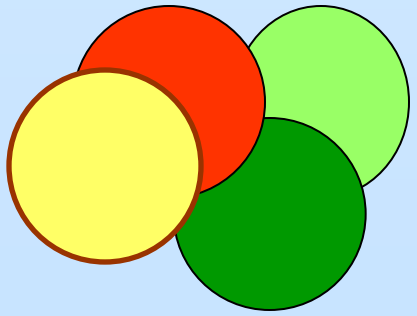


$3	$6	$4	$5

Tier 3

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

				
$	3	6	4	5



NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS

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

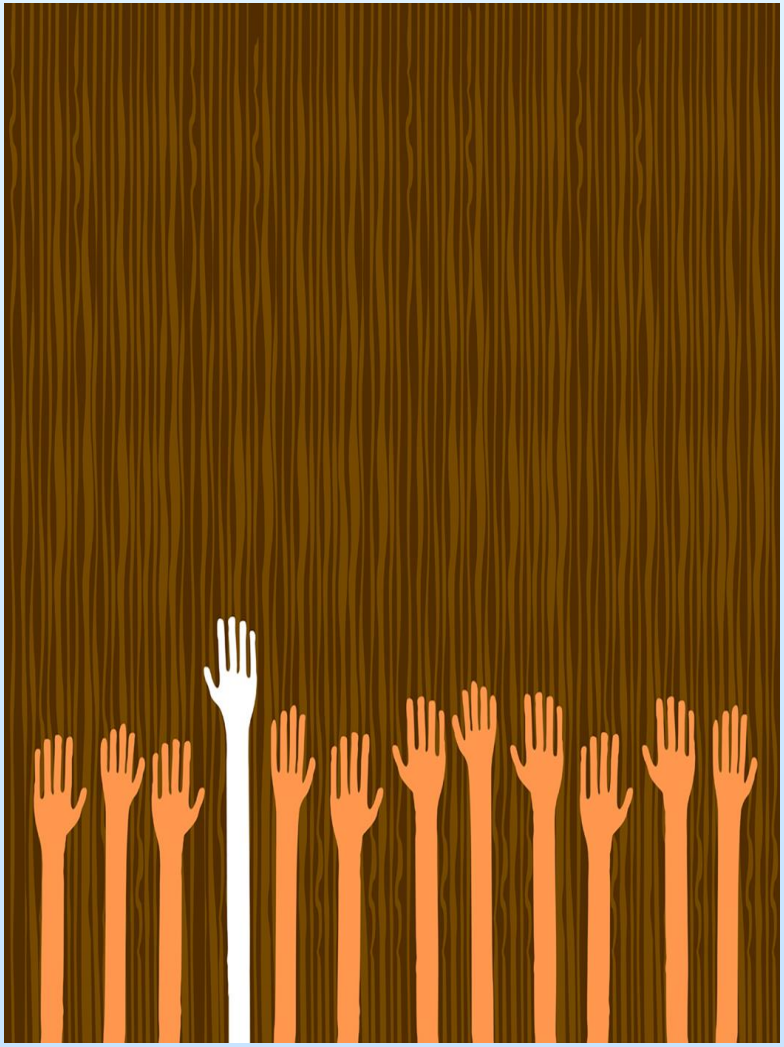
- **Support for teacher, students, school**
- **Support from all: community, family, *the village***
- **High Expectations**
- **Prior academic achievement**
- ***Careful planning for differentiated instruction***
- ***Seamless approach to content and assessment***
- **Creative teaching, grouping and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

Equity Principle, Principles to ACTION, NCTM, 2014

PSSM, NCTM, 2000

Thomas & Collier. *School effectiveness for language minority students,* NCBE. (1997)

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

Miriam Leiva

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