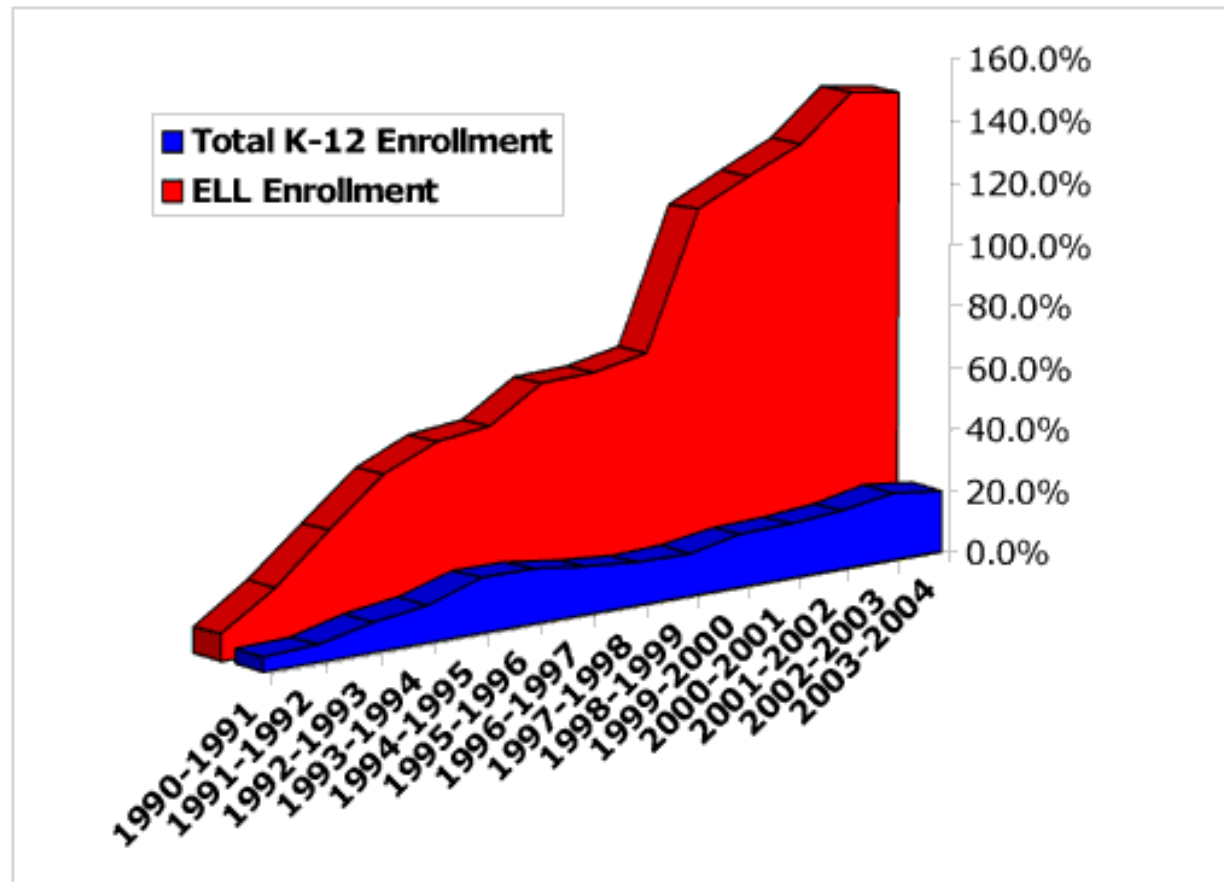


*Strategies that Address the Specific  
Learning Needs of  
English Language Learners  
in Mathematics*

*Dr. Bill Jasper, SHSU*  
[jasper@shsu.edu](mailto:jasper@shsu.edu)

*Southwest Educational Research  
Association Conference  
February 9, 2006  
Austin, Texas*

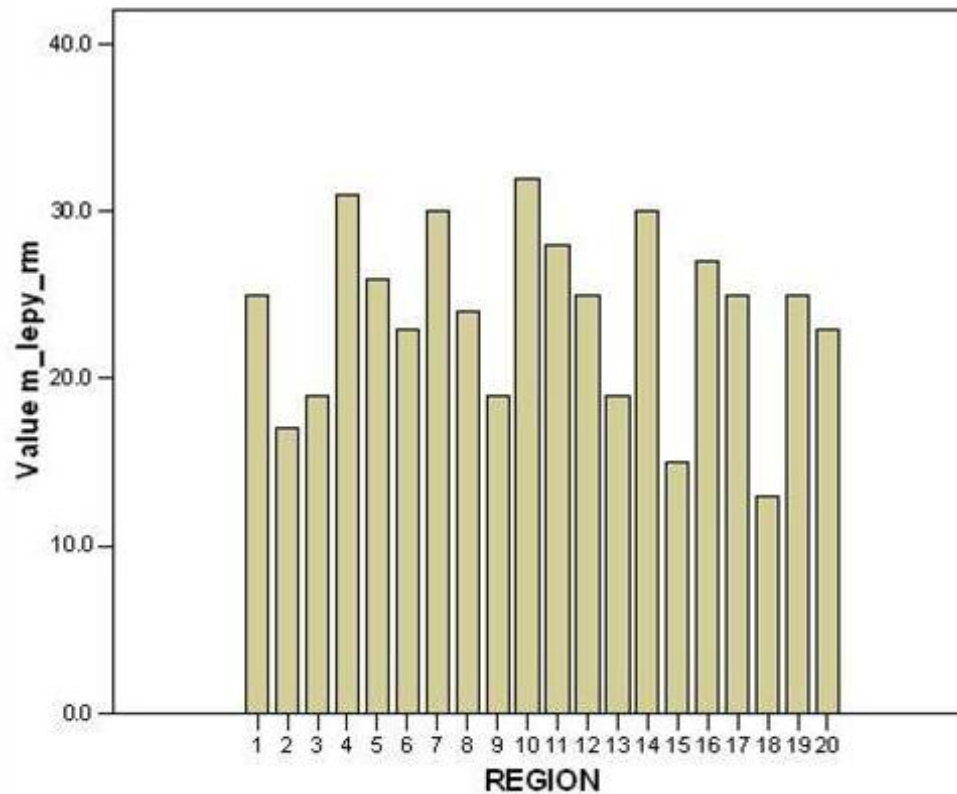
# *Relative Growth in ELL and Total Enrollment in U.S. Schools, 1989-90 to 2003-2004*



# *Research of Texas ELL Data*

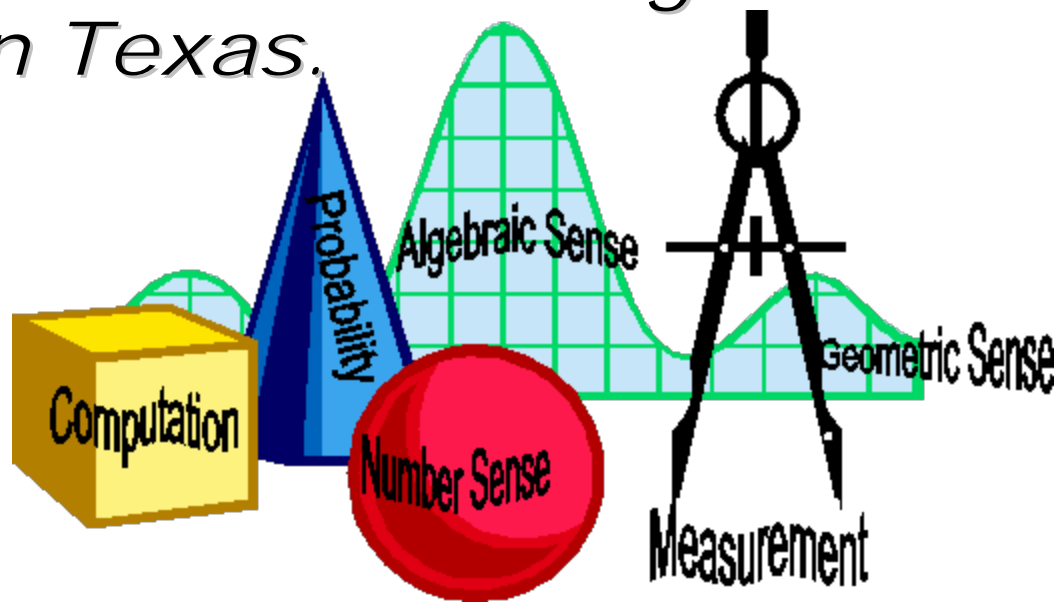
*Dr. Jaimie L. Hebert (SHSU)*

Percent Meeting Standard (Grade 10)

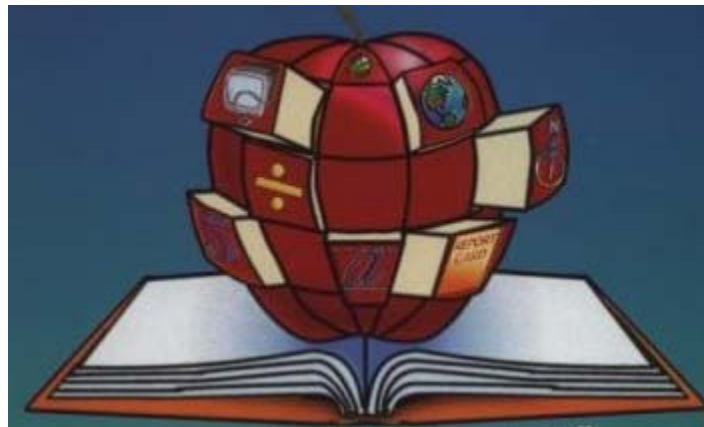


# *MELL Curriculum Development for Grades 6-11 Mathematics*

- *Develop curriculum for teaching mathematics to English Language Learners*
- *Teacher's Guide for Mathematics*
- *Ultimate goal is to empower Hispanics to pass Mathematics grade 11 Exit level test in Texas.*



# *Teacher's Guide to Teaching Mathematics for English Language Learners (MELL Project)*



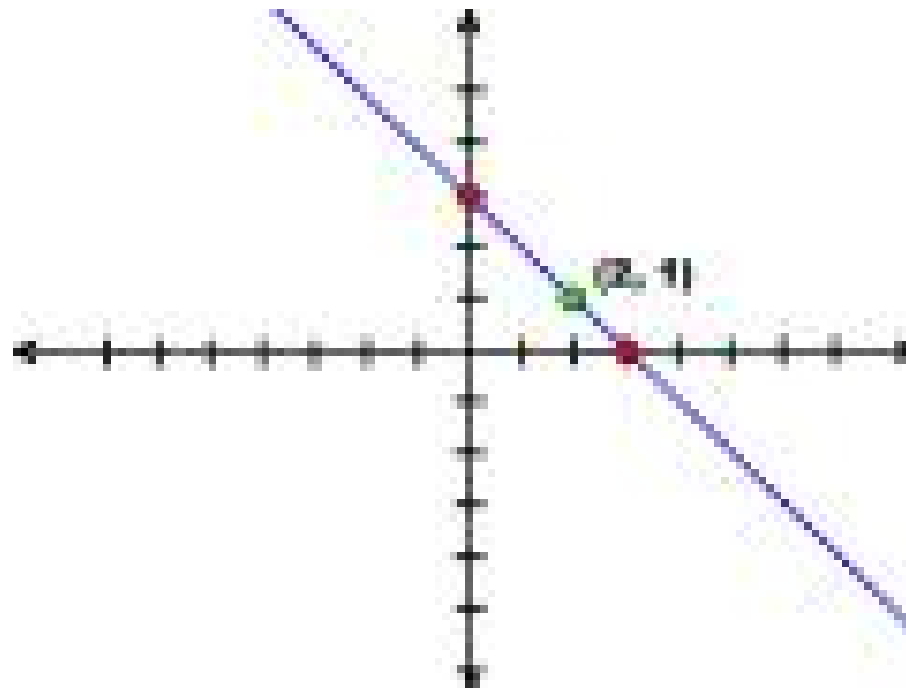
*Sam Houston State University  
Dr. Bill Jasper, Project Leader  
Dr. John Huber, Dr. Sylvia Taube,  
Carolyn Long  
Writers and Researchers  
Funded by: Texas Education Agency*

# *Guidelines for Preparing the Teacher's Guide*



- *Design instruction strategies and sample problems focused on the ELL and each learning objective*
  - *Identify prior mathematics knowledge requirements*
  - *Define mathematics vocabulary needed*
  - *Recommend good strategies for learning the vocabulary*

*Objective 1*  
*Describe functional*  
*relationships in a variety of*  
*ways*



# *Prior Mathematics Knowledge Brought to the Classroom*



- *Mathematics content issues:*
  - *Use of symbols*
  - *Use of algorithms*
  - *Different measurement systems*
  - *Different instructional strategies*



# *Prior Content Knowledge*

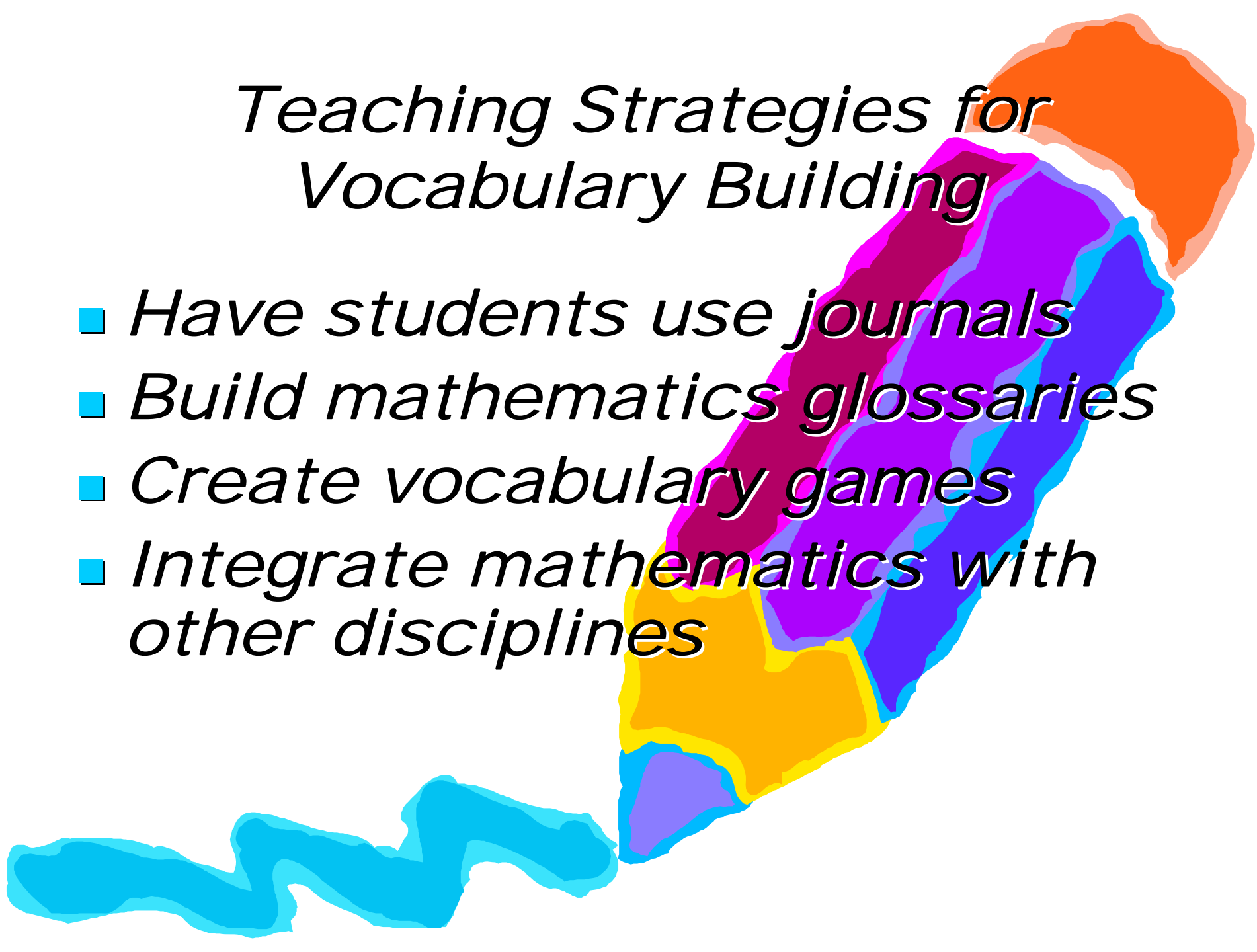
- 1. understand the concept of a variable;*
- 2. write and solve equations with one and two variables, using concrete models and algebraic expressions;*
- 3. write and solve inequalities with one and two variables;*
- 4. represent points as ordered pairs;*
- 5. graph points on an x-y coordinate plane (complete graphs with axes, positive and negative values, and all four quadrants);*

# *Prior Content Knowledge*

- 6. draw complete graphs of equations and inequalities on an x-y coordinate plane;*
- 7. record data for one and two variables in a table form;*
- 8. understand functional relationships as a table of values;*
- 9. identify patterns and proportional relationships between two variables; and*
- 10. determine the nth terms of a sequence of numbers or geometric figures.*

# *Teaching Strategies for Vocabulary Building*

- *Have students use journals*
- *Build mathematics glossaries*
- *Create vocabulary games*
- *Integrate mathematics with other disciplines*

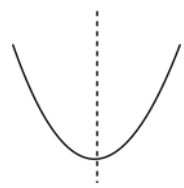
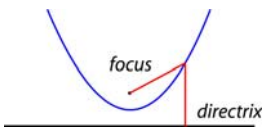
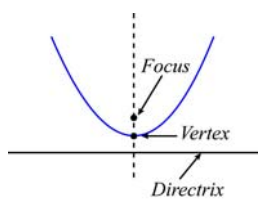


# *Strategies for Learning Vocabulary*

- 1. write definitions in everyday language while still allowing correct mathematics;*
- 2. use previously defined or common words in definitions and explanations;*
- 3. have students develop self-made glossaries of new vocabulary in journals, picture cards, or charts;*
- 4. as new vocabulary is introduced, add words and definitions with illustrations/explanations to classroom word wall;*
- 5. repeatedly connect the words to mathematical symbols and examples;*
- 6. tape record mathematical words, definitions and verbal examples, for students to play back when needed for extra support; and*
- 7. examine words from Greek and Latin prefixes, roots, and suffixes.*

# Mathematics Vocabulary Sample

## Minimum Mathematics Vocabulary Needed for Objective 5:

English term	Spanish term	Description/meaning	Drawing/example
axis of symmetry	eje de simetría  eh-heh deh see-meh-tree-ah	a line over which a graph is the mirror image of itself. Also called a line of symmetry.	<p>Axis of Symmetry</p> 
completing the square	completando el cuadrado  coh-m-pleh-than-do eh-lee-coo-ah-drah-tho	adding a term to an expression of the form $ax^2 + bx$ to produce a binomial square.	$x^2 + 3x = x^2 + 3x + \left(\frac{3}{2}\right)^2 - \left(\frac{3}{2}\right)^2$ $= \left(x + \frac{3}{2}\right)^2 - \frac{9}{4}$
parabola	parábola  pah-rah-boh-lah	the set of points in a plane equidistant from a point called the focus and a line called the directrix.	
quadratic function	función cuadrática  foon-seeohn-coo-ah-drah-tee-cah	a function of the form $f(x) = ax^2 + bx + c$ where $a \neq 0$ .	
vertex	vértice o cima  behr-tee-ceh oh see-mah	the point on the axis of symmetry of a parabola equidistant from the focus and the directrix.	

# *Guidelines for Preparing the Teacher's Guide (Cont.)*

- *Develop problem examples specific to each part of the objective*
- *Identify good strategies for assessment*
- *Create specific examples of activities to assess the learning of each objective*



# *General Strategies For Assessment*

- 1. allow students frequent opportunities to demonstrate mastery in a variety of ways;*
- 2. provide sufficient time for ELL students to complete assessment tasks;*
- 3. use assessment results to design instructional planning for remediation if needed;*
- 4. assign projects for students to work together with their partners;*
- 5. have students write their thoughts and problem-solving actions in a journal;*

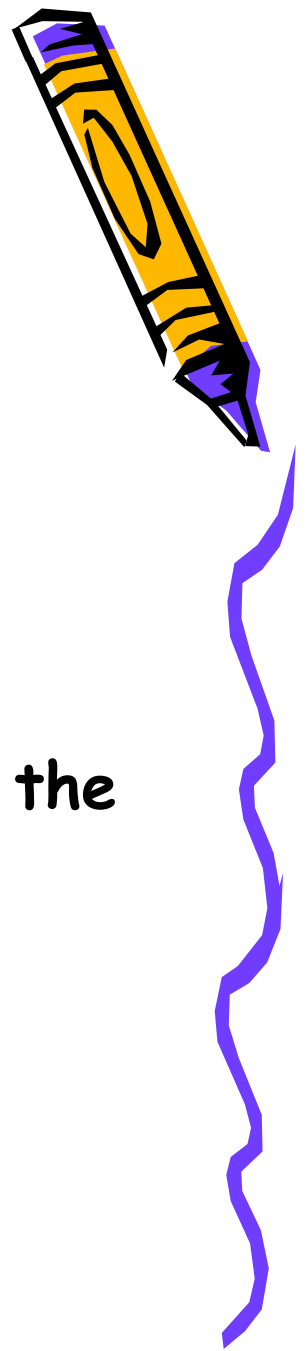
# *General Strategies For Assessment*

- 6. design performance measures with visuals to check concept understanding;*
- 7. design assessments to measure mathematical understanding, not reading comprehension;*
- 8. ensure assignments are as free of bias as possible; and*
- 9. make assignments that require writing explanations in English.*



# Effective Classroom Practices

- Establish a positive classroom climate
- Use commonly used English expressions
- Supplement learning materials
- Adjust assignments and assessments
  - Modify the language used (less formal) not the mathematical content
- Use Spanish phrases to acknowledge ELL's work or participation



# *Available Texas Resources*

- *Texas State University system website for teaching mathematics to English language learners (MELL) Teacher's Guide*
  - [www.tsusmell.org/](http://www.tsusmell.org/)
- *Released TAKS tests*
  - [www.tea.state.tx.us/student.assessment/resources/release/](http://www.tea.state.tx.us/student.assessment/resources/release/)
- *TAKS information booklets*
  - [www.tea.state.tx.us/student.assessment/taks/booklets](http://www.tea.state.tx.us/student.assessment/taks/booklets)

# *Available State Resources*

- *Charles A. Dana Center Algebra 1 and Geometry assessments*
  - [www.tenet.edu.teks/math/clarifying](http://www.tenet.edu.teks/math/clarifying)
- *Texas State University System/Texas Education Agency MELL teacher products*
  - [www.tsusmell.org](http://www.tsusmell.org)

# *Final Remarks*

- *Feedback from teachers using the Teacher's Guide "Draft"*
- *Future MELL Activities*
  - *Critical Campus Partnership with teachers in the Rio Grande Valley and ESC VI*
  - *Gather data on using the teachers guide*
  - *Measure TAKS test improvement*