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

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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)

Value m_lep_y'rm

REGION

IMEC Presentation, July 2005
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
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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.
Minimum Mathematics Vocabulary Needed for Objective 5:

<table>
<thead>
<tr>
<th>English term</th>
<th>Spanish term</th>
<th>Description/meaning</th>
<th>Drawing/example</th>
</tr>
</thead>
<tbody>
<tr>
<td>axis of symmetry</td>
<td>eje de simetr’a</td>
<td>a line over which a graph is the mirror image of itself. Also called a line of symmetry.</td>
<td>![Axis of Symmetry]</td>
</tr>
<tr>
<td>completing the square</td>
<td>completando el cuadrado</td>
<td>adding a term to an expression of the form ( ax^2 + bx ) to produce a binomial square.</td>
<td>[x^2 + 3x = x^2 + 3x + \left(\frac{3}{2}\right)^2 - \left(\frac{3}{2}\right)^2]</td>
</tr>
<tr>
<td>parabola</td>
<td>parábola</td>
<td>the set of points in a plane equidistant from a point called the focus and a line called the directrix.</td>
<td>![Parabola]</td>
</tr>
<tr>
<td>quadratic function</td>
<td>función cuadrática</td>
<td>a function of the form ( f(x) = ax^2 + bx + c ) where ( a \neq 0 ).</td>
<td></td>
</tr>
<tr>
<td>vertex</td>
<td>vértice</td>
<td>the point on the axis of symmetry of a parabola equidistant from the focus and the directrix.</td>
<td>![Vertex]</td>
</tr>
</tbody>
</table>
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

■ Texas State University System/Texas Education Agency MELL teacher products
  ▪ 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