Teaching Math to ELL’s: What does the Research Say?

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Texas and LEP students:

**Instruction of LEP students in Texas**
- More than 49,000,000 in U.S.
- Over 640,000 LEP students are enrolled in Texas public schools.
- Texas ranks second to California
- Over 350,000 in grades 3-12 test Spring 2007

**Language Groups Represented in Texas LEP Student Population**
- Spanish
- Urdu
- Korean
- Chinese
- Vietnamese
A Review of the Literature

• TSUS MELL Grant – Dr. Leslie Huling

• Literature Review requested by Dr. Paula Mueller (Then Mathematics Coordinator for TEA)

• Review Team
  • Dr. Jim Summerlin ASU
  • Dr. Paul Province Sul Ross
  • Dr. Sam Roberson Texas A&M- Commerce
  • Dr. Rebecca Miller Tarleton State
  • Dr. JoLynn Suell – U of Montevallo (Alabama)
  • Ms. Jessica Portillo – Alpine ISD
Goal of the Project:

• Review literature of ELL and the teaching of mathematics

• Identify what has worked

• Identify valid published research
Began with a wide net:

- Reviewed over 500 articles with any connection to “mathematics” and “ELL”
- Reviewed 200+ ELL organizational reports
- Reviewed 500+ websites, E-documents, homepages of organizations, and individuals regarding ELL research or practice
- Attended conferences on English Language Learners
- Analyzed numerous reports on the subject including Bilingual Education in Texas: Exploring Best Practices (The Bush School of Government & Public Service Texas A&M)
So what did we find?

- The Effect of Stating Problems in Bilingual Student’s First and Second Languages on Solving Problems in Mathematic
  
  *Allan Bernardo and Marissa Calleja (2005)*

- The Astounding Effectiveness of Dual Language Education for All
  
  *Virginia P. Collier and Wayne P. Thomas (2002)*

- Discourse Features of Written Mexican Spanish: Current Research in Contrastive Rhetoric and Its Implications
  
  *Montano-Harmon and Rosario (1991)*

- The Inclusive Classroom: Teaching Mathematics and Science to English Language Learners
  
  *Jarrett D. (1999)*

- Literacy Across the Curriculum: Myth, Mystery, or Biliteracy: The Case of Mathematics Education
  
  *Kostsopoulos, D. (2004)*

- Translation Difficulties in Learning Mathematics
  
So what did we find?

• The Effect of Stating Problems in Bilingual Student’s First and Second Languages on Solving Problems in Mathematics
  Allan Bernardo and Marissa Calleja (2005)

• Studies conducted by Manila College of Education (Philippines)
  • Filipino-English bilingual students
  • Classes taught in English
  • State the mathematical word problem in English or Filipino
  • L1 - Filipino and L1 - English
  • More successful in solving the problem if it was stated in L1
So what did we find?

• The Astounding Effectiveness of Dual Language Education for All

• Studies conducted in 23 districts in 15 states over two decades
  • Remediation versus Enrichment
  • Remediation – Intensive English, ESL, pullout ESL content/
    sheltered, transitional bilingual, etc.
  • Enrichment – Dual language instruction (no translation, no repeat
    lessons), peer teaching, total separation of languages
  • Work equally well for One-way and Two-way (70:30 minimums)
So what did we find?

- **Discourse Features of Written Mexican Spanish: Current Research in Contrastive Rhetoric and Its Implications**
  Montano-Harmon and Rosario (1991)

- Writings analyzed by expert readers and linguistically coded
  - Mexican students in Mexico
  - Native Mexicans in ESL programs in US
  - Mexican-Americans, dominant in English writing in English
  - Anglo-Americans, native English speakers, writing in English

- The four groups differ **significantly** in logical development of text
  - Direct translation is not effective
  - Affects literacy skills especially in linear versus complex composition
So what did we find?

- The Inclusive Classroom: Teaching Mathematics and Science to English Language Learners  Jarrett D. (1999)

- Two language conventions are displayed in the classroom
  - Social language (interactive, concrete, contextual, visual clues)
  - Academic language (isolation, abstract, specific)
  - Content specific vocabulary at odds with conventional literacy
- Requires literacy in specific register
  - Word-for-word translation is not effective
  - Example: “Factor this expression”
So what did we find?

- Translation Difficulties in Learning Mathematics

- Two language conventions are displayed in the classroom
  - Written and spoken language
  - Mathematical notation
- No unique correspondence English to Symbol
  - Word-for-word translation is not effective
  - Word order does not correspond to symbol order
  - Spoken/written is complex and connotes – Equation’s order is specific and denotes
So what did we find?

- There is a paucity of research specific to mathematics and ELL students.

- The consensus is that content mastery and the principles of literacy are tied together—content and literacy go hand-in-hand.

- Difficulty in the translation of word problems is quite universal (K-16), not just limited to ELL students or American Students.

- Two-way dual language programs hold the most promise for all content delivery (see Thomas & Collier, 2002).

- That mathematics has a natural language register and a formal content language register and the teaching of these registers is critical to student’s understanding of math, beginning in the elementary school.
Recommendations:

- Support and fund research to continue defining programs that tie literacy to content instruction, particularly as it concerns mathematics.

- Support and fund the development of Two-way dual language programs at all school levels. *Texas Association for Bilingual Education recommends One-way or Two-way Dual Language Immersion*.

- Support and fund professional development for teachers regarding needs of ELL students and instructional practices that support dual language teaching.

- **Enhance teacher preparation programs**
  - Require math teachers to have formal training in second language acquisition.
  - Rigorous training for math teachers in usage of the math register and translation skills.
  - Create Dual Language Teaching Certification(s) ??