

*Helping ELL Students Bridge
the Language Barrier in
Mathematics*

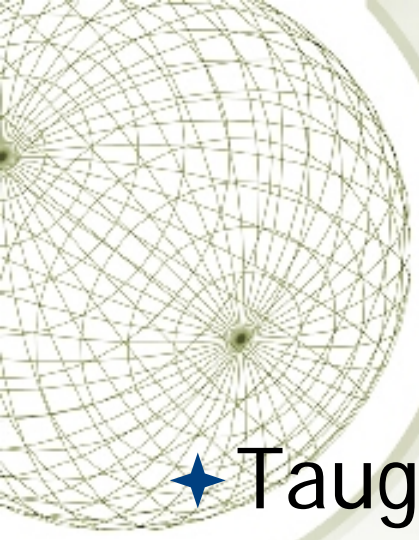
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MELL conference 2008

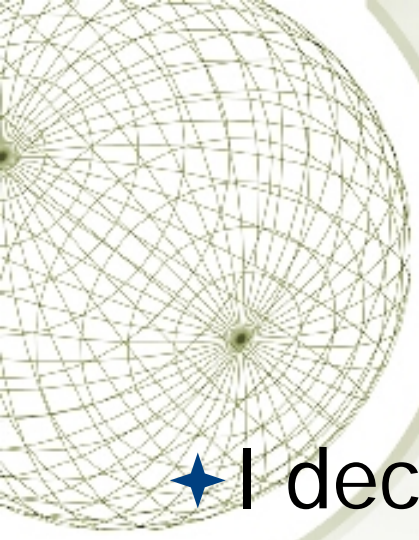
Where is El Paso, TX?





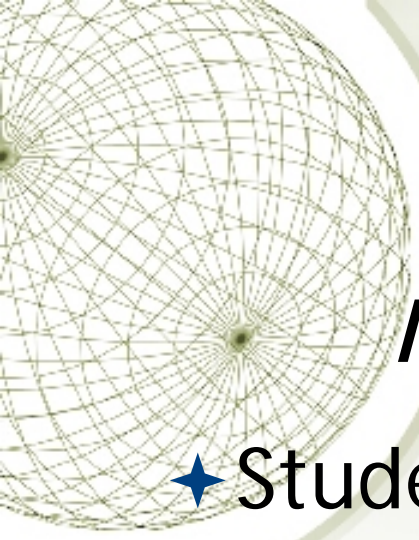
My Background

- ★ Taught at a High school with 56% Hispanic students
- ★ I was hired to teach mathematics to ELL students
- ★ No resources to help me teach ELL students mathematics (No, I do not want to translate the math book!)




I needed HELP!

- ★ I decided to research the issue
- ★ I examined the research regarding how one learns mathematics and how one learns a new language.
- ★ The similarities between the fields of research would provide an answer to my dilemma.



Learning language and mathematics: Similarities

- ★ Students learn a new language and mathematics more effectively when:
 - ◆ They write to communicate what they have learned
 - ◆ They learn in groups
 - ◆ The learning is set in context



Mathematics as a Second Language

- ★ By synthesizing the research, I created an approach for teaching ELL students mathematics which I called Mathematics as a Second Language (MSL)



Components of MSL

- ★ Vocabulary Activities
- ★ Journals
- ★ Group Work
- ★ Projects



Creating a Culture of the Classroom

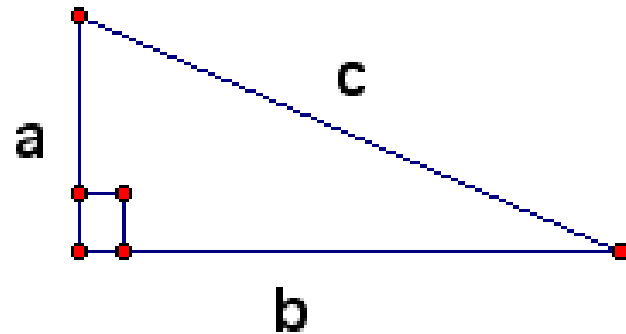
- ★ For MSL to work, there has to be certain conditions in the classroom that promote learning.
 - ★ Everyone participates
 - ★ There are no wrong answers, only opportunities for learning
 - ★ Students determine the correctness of the mathematics
 - ★ Teacher serves as a resource and a guide


Word Squares (Vocabulary)

Teorema Pitagórica

Pythagorean Theorem

Para un triángulo recto,
 $a^2 + b^2 = c^2$





Create Your Own Word Square

- ★ Create your own word square for mathematical terms commonly used in your classroom.
- ★ Suggestions for terms: function, fraction, parabola, ratio, proportion, integer...



Introducing Vocabulary

- ★ There is some question about when teachers should introduce vocabulary.
- ★ Front loaded vs. In context
- ★ In context allows students to understand the concept before naming it.
- ★ Front loaded good for words that are essential to know before the lesson starts.



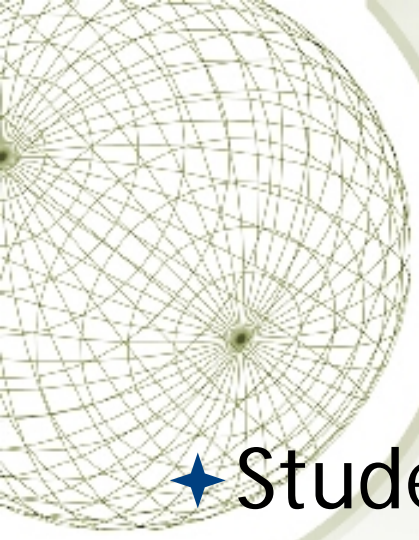
Benefits of Word Squares

- ★ Had to do more than just memorize a definition. Students had to understand the concept in order to put it in their own words.
- ★ Students could keep their Word Squares the rest of their school career. This helped my students when they had another teacher who was not trained in ELL methodology.



Group Work

- ★ Three important factors of group work:
 - ★ Groups should not be homogenous in their language ability
 - ★ Groups need to change periodically
 - ★ ELL students need to learn how to participate in groups. (Creating the Culture of the Classroom)



Benefits of Group Work

- ★ Students' use of mathematical terms increased
- ★ Communication became more mathematical
- ★ Students' mathematical understanding increased



Journals

- ★ Students would write in their journals at the end of each class
- ★ Tried to have students write in their journals at least four days per week.
- ★ On Fridays, students would evaluate each other's journals



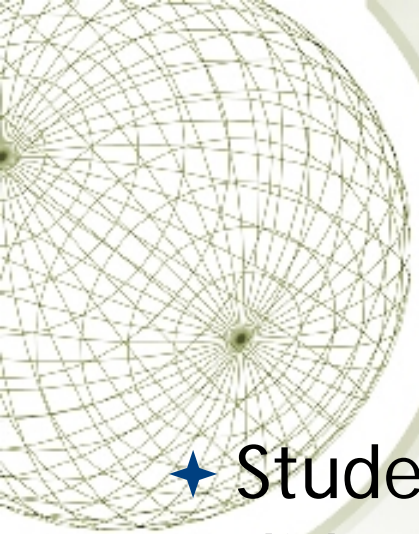
Rubric for journals

Score	Rationale
0	No work
1	Cannot understand entry
2	Some understanding of entry, perhaps off topic
3	Complete understanding of entry, on topic



Let's practice!

- ★ Take five minutes to respond to the journal prompt below:
 - ★ Describe the sign rules for integer multiplication. Give a justification for the rule of multiplication of a negative and a positive number.
- ★ Exchange your journal entry with a neighbor. Evaluate your neighbor's journal using the rubric. Justify your evaluation (score).



Benefits of Journals

- ★ Students had to decide what they knew and did not know about the mathematics topic
- ★ Improved mathematical communication
- ★ Students increased their use of English
- ★ Encouraged mathematical discussions among students



Projects

- ★ Real-life contexts for projects (stock market or social issues).
- ★ Had to report the results of their project to their peers.
- ★ Worked in groups to complete the project



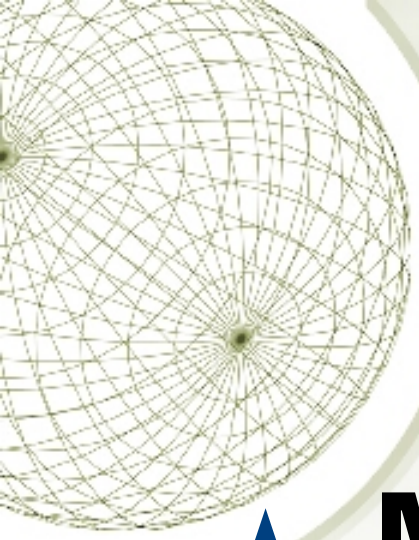
Projects

- ★ Usually took a week or more to complete (stock market project lasted one month)
- ★ At the beginning of the projects, I shared the rubric I was going to use along with examples of projects to practice evaluating with students.



Benefits of Projects

- ★ Students got a glimpse of the usefulness of mathematics in everyday life.
- ★ More mathematical communication in the classroom (Do you have the business section of the paper? My stocks are down 3%.)




Did MSL Work?

★ Maybe!



Did MSL Work

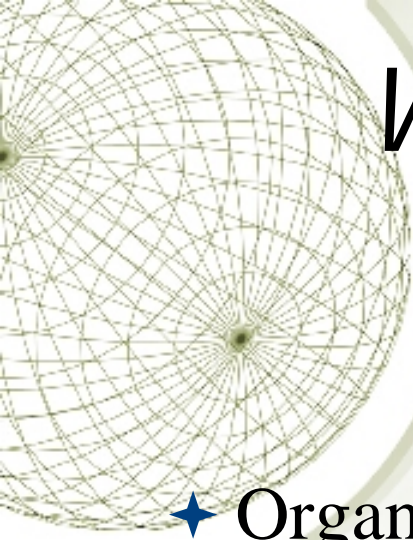
- ★ MSL seemed to promote communication about mathematics (student initiated conversations about mathematics and mathematical reasoning)
- ★ MSL seemed to help students use the language of mathematics more efficiently



What if you don't speak the language?

- ★ Group Work

- ★ ELL Student assistants in each group
- ★ Glossaries in the second language
- ★ Bilingual aides
- ★ Foreign language teachers
- ★ Learn a new language



What does PSSM say about students' mathematical communication? (p. 60)

- ★ Organize and consolidate their mathematical thinking through communication;
- ★ Communicate their mathematical thinking coherently and clearly to peers, teachers, and others;
- ★ Analyze and evaluate the mathematical thinking and strategies of others;
- ★ Use the language of mathematics to express mathematical ideas precisely.



Let's Work Together

- ★ Try some MSL activities and let me know how they went for you.
- ★ mwinsor@utep.edu
- ★ <http://www.math.utep.edu/Faculty/mwinsor/>
- ★ Winsor (2007). Bridging the language barrier in mathematics. *Mathematics Teacher*. 101(5). p.372-378