“Westerners like their fish firmly dead”:

Fun and Useful TEKS and ELPS-Based Tips for Teaching English Language Learners

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Why do we teach mathematics?

- GOAL - appropriation of methods, tools, concepts based on cognitive processing at three levels
  - Procedures and operations
  - Concepts
  - Insights
- Mathematical activity seeks to make meaning from aspects of patterns and relationships through abstraction.

" '[T]he learning of mathematics (is) . . . very dependent on good teaching. Now, to know mathematics is one thing, and to be able to teach it--to communicate it to those at a lower conceptual level is quite another'" *(Skemp, 1971, p. 36, qtd in Brahier, 2005, p. 35).*

- $2\ ^{1}/_{2} \div\ ^{1}/_{4}$
- SOLVE
- TEACH
- CREATE A WORD PROBLEM

“We should all avoid misunderstandings, of course, and seek to correct them when they occur. We should tactfully help others when they misunderstand us, and be ever alert to our own feeble-minded incomprehensions of other people and the state of the world generally” (Spencer, 2008).

- “The way many westerners like their fish: firmly dead”

QuickTime™ and a
decompressor
are needed to see this picture.

Learning Theory

- Jerome Bruner
  - Enactive
  - Iconic
  - Symbolic
- Van Hiele
  - 0 - Visualization
  - 1 - Analysis
  - 2 - Informal deduction
  - 3 - Deduction
  - 4 - Rigor

Learning as a Recursive Process

- Practice
- Gain Insight through Interactive Revision
- Extend Work into Exhibition
- Develop Concepts and Procedures

Exponent Lab

Chapter 74 and Chapter 111

- ELPS on which I'm focusing today:
  - 74.4 c 1 A, H
    - Secondary Cross-curricular L2 acquisition learning strategies
      - Use prior knowledge and experience to understand meaning
      - Develop and expand repertoire of learning strategies (reasoning, analyzing)
    - 74.4 c 2 C, E
      - Secondary Cross-curricular L2 acquisition listening
        - New language structures and academic vocabulary
        - Visual, contextual, linquistic support

Cont'd

- 74.4 c 4 D, I, J, K
  - Secondary Cross-curricular L2 acquisition reading
    - Use pre-reading supports
    - Demonstrate understanding of supporting ideas
    - Employ inferential skills
    - Employ analytical skills

Cont'd

- TEKS on which I'm focusing today:
  - 111.22. Mathematics, Grade 6. b 6.11 A
    - Identify and apply mathematics to everyday experiences
  - 6.12 A
    - Communicate mathematical ideas using language, tools, units, and models
  - 111.23. Mathematics, Grade 7. 7.13 A, 7.14 A
  - 111.24. Mathematics, Grade 8. 8.14 A, 8.15 A


TEKS/TELPS/MELL
connections
DEFINE
IDENTIFY properties
LIST Uses
RELATE to standards

Standard Exploration

- Multiculturalism/Intercultural purposes and communication
  - ". . . she was still speaking to her son in a language I did not understand. . . a combination of Spanish, English, and . . .Otomi. Inez . . . said, [I have to speak to him in all three languages to make sure that it sticks.]"
- Perceptions?

NCTM Goals for Ss

- 1. To understand and value mathematics
- 2. To reason mathematically
- 3. To communicate mathematically
- 4. To solve problems
- 5. To make connections to contexts and other academic subject areas

NCTM Goals for Ts

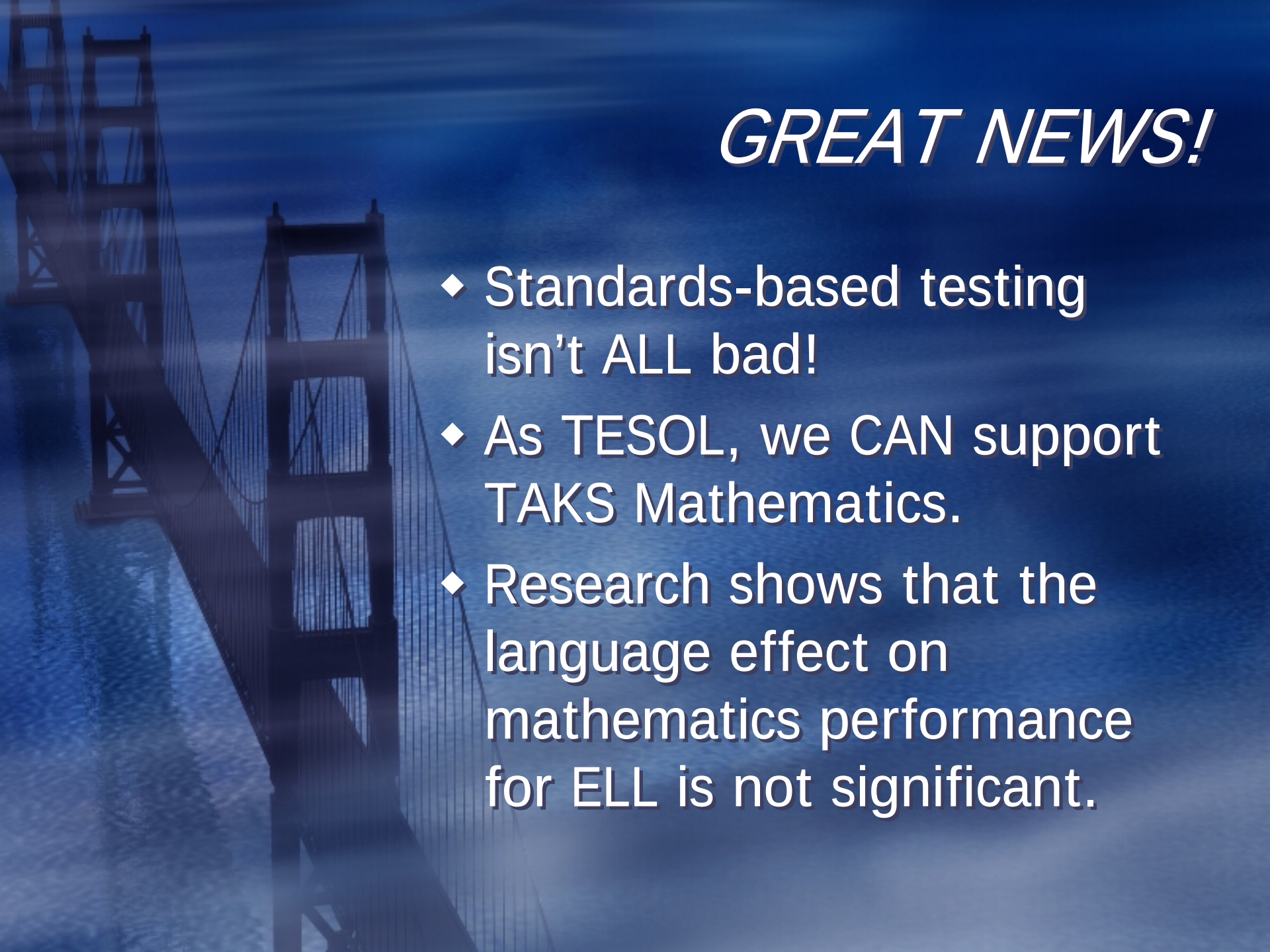
- Select mathematical tasks to engage Ss in intellect and interest
- Provide opportunities to deepen Ss understanding on mathematics and its applications
- Orchestrate classroom discourse in ways that promote the investigation and growth of mathematical ideas
- Help Ss use technology and other tools to pursue mathematical investigations
- Help Ss seek connections to previous and developing knowledge
- Guide individual, small-group, and whole-class work

TESOL's ELPS

- The ELL will communicate for social, intercultural, and instructional purposes within the school setting.
- The ELL will communicate information, ideas and concepts necessary for academic success in the area of language arts.
- . . .the area of mathematics.
- . . .the area of science.
- . . .the area of social studies.

NCATE's Standards for Teachers of ELLs

- 1. Teachers should acquire pedagogical content knowledge which addresses ELLs.
  - Know ELL strategies for content area instruction such as "Language Arts Methods to Teach Math"
- 2. Assessments and evaluation data should measure teachers' preparedness to work with ELLs.
- 3. Field experiences should provide practice and opportunities to see successful teachers model effective techniques in working with ELLs.
- 4. Candidates should understand the range and diversity among ELLs.
- 5. & 6. Unit should provide qualified faculty and sufficient resources to support teachers learning about ELL.


GREAT NEWS!
Standards-based testing isn't ALL bad!
As TESOL, we CAN support TAKS Mathematics.
Research shows that the language effect on mathematics performance for ELL is not significant.

More on ELL and Testing

- Both native and non-native speakers have trouble with test items identified as linguistically difficult:
  - Difficult mathematics vocabulary
  - Ambiguous/multiple-meaning words
  - Colloquial/slang
  - Comparatives
- For ELLs, accomodations of glossaries or word lists are proven effective.
- Standards-based tests are proven fair and valid for ELLs.

Why MELL Matters

- > 5 million ELLs in US public schools (57% increase in past 10 years) - diversity among this group
- 6 in 10 of ELLs free/reduced lunch
- 8th grade ELLs perform to less than 50% the level of their non-ELL peers in reading and mathematics
- Only 29.5% of teachers with 1 or more ELLS have training
- Only 20 states require ELL training
- < 1/6 of colleges offer pre-service training in ELL
- Only 57% of teachers believe ELL training is necessary

- Teaching Math in the 1960s:
"A logger cuts and sells a truckload of lumber for $100. His cost of production is four-fifths of that amount. What is his profit?"

Teaching Math in the1970s (the new-math):
"A logger exchanges a set (L) of lumber for a set (M) of money. The cardinality of Set M is 100. The set C of production costs contains 20 fewer points. What is the cardinality of Set P of profits?"

Teaching Math in the 1980s :
"A logger cuts and sells a truckload of lumber for $100. Her cost is $80, her profit is $20. Find and circle the number 20."

Teaching Math in the 1990s:
"An unenlightened logger cuts down a beautiful stand of 100 trees in order to make a $20 profit. Write an essay explaining how you feel about this as a way to make money. Topic for discussion: How did the forest birds and squirrels feel?"

Teaching Math in the 2000s?

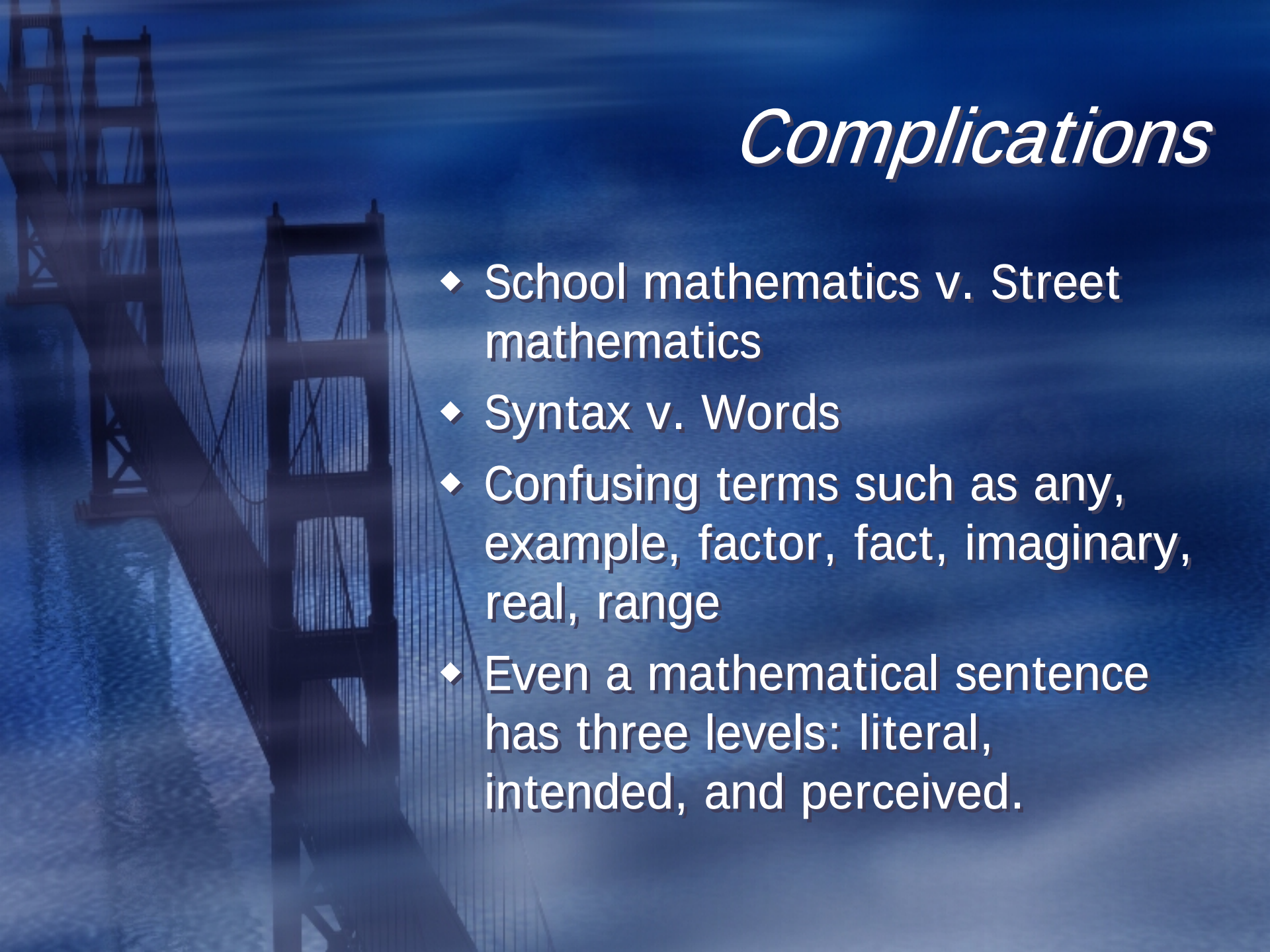
- Direct Instruction
- Scaffolding
- Self-regulation/monitoring
- Modeling
- Intrinsic motivation
- Formative assessment
- Time-on-task
- Tools and opportunities for critical and creative thinking
- Inquiry learning

The Language of Mathematics

- >4,000 languages in the world
- ALL have words for objects (NOUNS) and actions (VERBS)
- Mathematics IS a language
  - NOUNS - numbers, measurements, shapes, spaces, functions, patterns, data, arrangements (CONTENT)
  - VERBS - modeling and formulating, transforming and manipulating, inferring, communicating (PROCESS)

Common Ground

- All cultures use mathematics in some shape or form for spatio-temporal declination; change, constancy, steady states; order, organization, systems; balance, continuity, symmetry; abstratction; need for rigor



Complications

- School mathematics v. Street mathematics
- Syntax v. Words
- Confusing terms such as any, example, factor, fact, imaginary, real, range
- Even a mathematical sentence has three levels: literal, intended, and perceived.

Examples of mathematics language

- Additive identity: p+0=p; 0+p=p; adding zero to a quantity give the same quantity.
- Arithmetic negation: m-h=m+(-h); subtracting a quantity is the same as adding its opposite.
- Opposite of opposite: because the opposite of the opposite of a quantity is the quantity itself, in general, -(-p)=p.

Cont'd

- Mathematics, like other linguistics, is ultimately social.
- "Mathematics is accessed through accounts humans offer about it. Any attempt to locate the underlying truth of mathematics results in us encountering what Lacan calls the 'lack'; the emptiness which emerges after the final layers of description are peeled away" (Brown, 2001, p. 57).
- Mathematics and culture inherently linked - counting and ten from fingers

But what does it all mean?

- All mathematics learners can benefit from certain language based strategies. ELLs especially because our English words for mathematics will be equally foreign to them.

How do we learn mathematics?

- Operant Behavior
- Nativist
  - Universal Grammar
  - Generative Grammar
- Social/Cultural
  - Competence
  - Speech-acts
  - Vygotsky
    - ZPD
    - Mediation
    - Scaffolding

Effective Mathematics Instruction for ELLs

- Context/Process/Content
  - CONTEXT
    - Role of L1 - capitalize on inherent strengths of Ss
    - Problem solving comprehension - determining meaning in context.
    - Family involvement - culture, invitations to events and meaningful assessments (displays and projects), home visits
    - Student-oriented communication
    - Community Resources

Cont'd

- PROCESS
  - Teacher collaboration
    - Professional Development Schools
    - Learning Centers
    - Socio-cultural approaches
      - Assess your own knowledge
      - Assess the classroom
      - Probe for child's strength
      - Gather data by monitoring interactions within groups

Cont'd

- Differentiation - language challenges, variety of assessments
- Grouping - different cultures perform differently in different groups

- CONTENT
  - Vocabulary - ASM to metric, writing numbers in words, connect to every day meanings, beware of false cognates, sentence structure, relate to culture, teach across the curriculum

Writing and Mathematics

- Students cannot all talk at the same time, but they can write at the same time.
- Journaling allows differentiation in problem solving.
- Drafts and revisions allow students to take ownership over their mathematics work.
- Peer editing can become a part of mathematics, enhancing opportunities for language interaction for ELLs.

" '[b]ecause mathematics is so often conveys in symbols, oral and written communication about mathematical ideas is not always recognized as an important part of mathematics education. Students do not necessarily talk about mathematics naturally; teachers need to help them to do so'"
(NCTM, 1996, p. 60, in Kenney, 2005, p 10).

- Reading Strategies
  - Literacy Specialist in mathematics class to teach mathematics specific problem solving reading skills
  - Ts model thinking out loud.
  - Children's Literature (*Grapes of Math,* e.g.)
  - Amplify Language
    - E.g. (When you round a number, you are making it either a bit (slightly) larger or slightly (a bit) smaller.

Integration of Technology

- Brownsville uses COWs
- Potential for ELL assessment in Texas to move to online
- Research shows that Internet activities and computer games can encourage ELLs to use L2. (Computers don't judge)
- The technology helps serve Bruner's enactive and iconic stages while L2 develops so ELL is ready for mathematics acquisition in L2 with symbolic learning.

Cultural Literacy

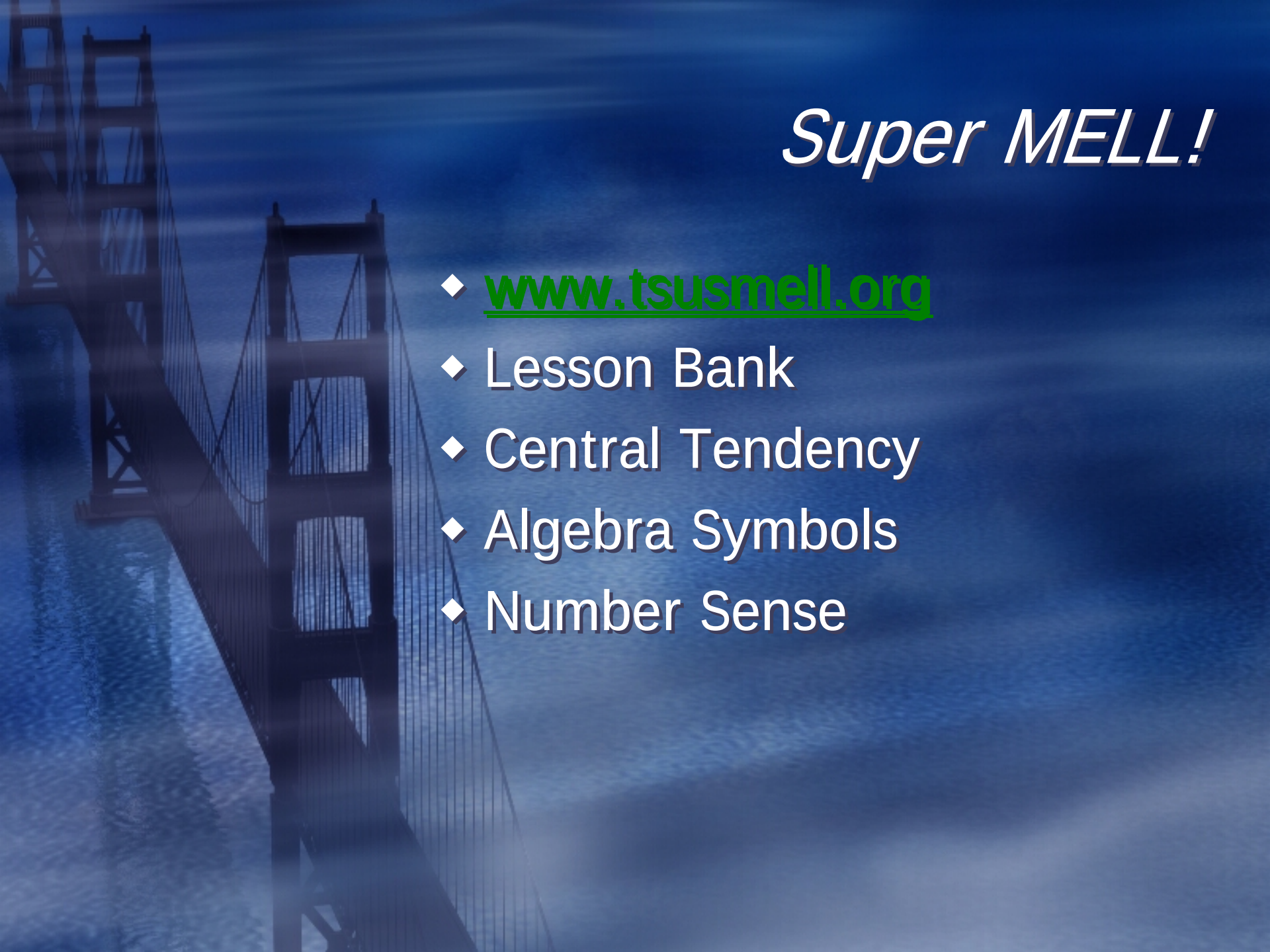
- Remember E.D. Hirsch?
- Mathematics curriculum question
  - Applied mathematics v. school mathematics
  - Orientalism v. Anglicism
  - CONTEXT v. CONTENT
  - Competition in American workforce, in Global Economy

What I do

- building your own multiplication chart
- concepts of multiplication
- division as the reciprocal of multiplication
- vocabulary as part of math
- reading and writing as part of math

Concept Builders

- Division Example


Super MELL!
www.tsusmell.org
Lesson Bank
Central Tendency
Algebra Symbols
Number Sense

Thank you

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References

Adamson, H.D. (2005). *Language minority students in American school: An education in English*. Lawrence Erlbaum Associates: Mahwah, NJ.

Arrowood, J.C. (2004). *Mathematics for ESL Learners*. Scarecrow Education: Lanham, MD.

Basurto, I. (1999). "Conditions of reading comprehension which facilitate word problems for second language learners." *Reading Improvement 36*(3): 143-8. Web.

Beck, J.K. (2009). *"Teaching Every Kind of Professional Development."* http://www.freewebs.com/tkdpower retrieved on 29 June 2009.

Brahier, D.J. (2005). *Teaching secondary and middle school mathematics, second edition*. Pearson: Boston.

Brown, T. (2001). *Mathematics education and language: Interpreting hermeneutics and post-structuralism, revised second edition.* Kluwer Academic Publishers: Dordrecht.

References p 2

Chang, M. (2008). “Teacher instructional practices and language minority students: A longitudinal model.” *The Journal of Educational Research 102*(2): 83-97. Web.

DiGisi, L.L., & Fleming, D. (2005). “Literacy specialists in math class!: Closing the achievement gap on state math assessments.” *Voices from the Middle (13)*1: 48-53. Web.

Ernst-Slavit, G. & Slavit, D. (2007). “Education reform, mathematics, & diverse learners: Meeting the needs of all students.” *Multicultural Education 14*(4): 20-7. Web.

Ganesh, T.G. & Middleton, J.A. (2006). “Challenges in linguistically and culturally diverse elementary settings with math instruction using learning technologies.” *The Urban Review 38*(2): 101-139. Web.

Kenney, J.M., Hancewicz, E., Heuer, L., Metsisto, D. & Tuttle, C.L. (2005). *Literacy strategies for improving mathematics instruction*. ASCD: Alexandria, VA.

Kinard, J.T., Sr. & Kozulin, A. (2008). *Rigorous mathematical thinking: Conceptual formation in the mathematics classroom*. Cambridge UP: Cambridge.

References p 3

"Lesson Bank" *TSUS MELL*. Retrieved 29 June 2009 from http://www.tsusmell.org

Machado-Casas, M. (2009). "The politics of organic phylogeny: The art of parenting and surviving as transnational multilingual latino indigenous immigrants in the U.S." *The High School Journal 92* (4): 82-99. Web.

Sadowski, M. (2004). *Teaching immigrant and seond-language students: Strategies for success*. Harvard Ed Press: Cambridge, MA.

Shaftel, J., Belton-Kocher, E., Glassnapp, D., & Poggio, J. (2006). "The impact of language characteristics in mathematics test items on the performance of English language learners and students with disabilities." *Educational Assessment 11*(2): 105-126. Web.

Silva, C., Weinburgh, M., Smith, K.H., Barreto, G., & Gabel, J. (2008/2009). "Partnering to develop academic language for English language learners through mathematics and science." *Childhood Education 85* (2): 107-12. Web.

References p 4

Spencer, R. (2008). “A case of cultural confusion.” *Telegraph.co.uk, 16 Jan 2008* Retrieved from Jonna K. Beck’s Facebook http://www.facebook.com/ext/share.php?sid=125588072726&h=C0fnU&u=1RZik&ref=mf on 29 June 2009.

SRA corrective mathematics series guide: A direct instruction program (2005). SRA/McGraw Hill: Columbus, OH.

TEA (2007). *Chapter 74. Curriculum requirements: Subchapter A. Required curriculum.* Retrieved 25 June 2009 from http://ritter.tea.state.tx.us

TEA (1998). *Chapter 111. Texas essential knowledge and skills for mathematics.* Retrieved 25 June 2009 from http://ritter.tea.state.tx.us

“Waking Minds V. 2.0 Demo v.8.8 Slideshow.pps” CDI America. Web.

Young, J.W., Cho, Y., Ling, G., Cline, F., Steinberg, J. & Stone, E. (2008). “Validity and fairness of state standards-based assessments for English language learners.” *Educational Assessment 13*: 170-192. Web.

Zuger, S. (2009). “English language learners take to tech.” *Technology & Learning 29* (8): n.p. Web.