Mathematics for English Language Learners

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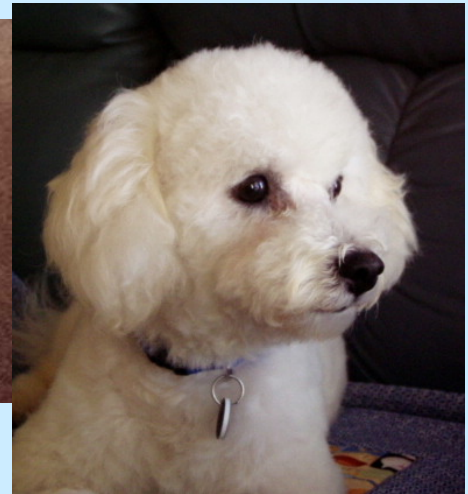# Using Grammar to Teach Algebra
and Other Unusual Approaches to Help ELLs Learn Math

Presented by
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About Deborah Svedman:

- 28 years teaching experience in El Paso
- Master's in Bilingual Education
- National Board Certified Teacher in math
- Certified in Texas for secondary math, general elementary, and bilingual/ESL
- Taught all levels: 1st grade – graduate school
- I despise boring, pointless in-service, too
- I have four rescued dogs*

Agenda

 5 minutes – Introduction, background, agenda

 5 minutes – Language Acquisition Theory (brief)

20 minutes – Modifying vocabulary

50 minutes – Concrete to Abstract – Using grammar to teach Distributive Property and Factoring; solving equations, simplifying expressions

10 minutes – Other research on ELLs – non academic issues, parental involvement; closure and Q&A

Language Acquisition Theory:
Explaining BICS and CALP

Classroom teachers need to understand the difference between social language and academic language acquisition. Here is a simple description of BICS and CALP by Judie Haynes, as theorized by language acquisition expert Jim Cummins:

Basic Interpersonal Communication Skills (BICS)

➤ Are the language skills needed in social situations, the day-to-day language needed to interact socially with other people.

➤ English language learners (ELLs) employ BIC skills when they are on the playground, in the lunch room, on the school bus, at parties, playing sports and talking on the telephone.

➤ Social interactions are usually context embedded. They occur in a meaningful social context.*

Basic Interpersonal Communication Skills (BICS)

➢They are not very demanding cognitively. The language required is not specialized.

➢These language skills usually develop within six months to two years after arrival in the U.S.

➢Problems arise when teachers and administrators think that a child is proficient in a language when they demonstrate good social English.*

Cognitive Academic Language Proficiency (CALP)

➢ CALP refers to formal academic learning. This includes listening, speaking, reading, and writing about subject area content material.

➢ This level of language learning is essential for students to succeed in school. Students need time and support to become proficient in academic areas.*

Cognitive Academic Language Proficiency (CALP)

➢ This usually takes from five to seven years. Recent research (Thomas & Collier, 1995) has shown that if a child has no prior schooling or has no support in native language development, it may take seven to ten years for ELLs to catch up to their peers.

➢ Academic language acquisition isn't just the understanding of content area vocabulary. It includes skills such as comparing, classifying, synthesizing, evaluating, and inferring.*

Cognitive Academic Language Proficiency (CALP)

➢ Academic language tasks are context reduced. Information is read from a textbook or presented by the teacher. As a student gets older the context of academic tasks becomes more and more reduced.

➢ The language also becomes more cognitively demanding. New ideas, concepts and language are presented to the students at the same time. *

Common Underlying Proficiency

➤ Jim Cummins also advances the theory that there is a common underlying proficiency (CUP) between two languages. Skills, ideas and concepts students learn in their first language will be transferred to the second language.*

"SHOW, DON'T TELL"

- Demonstrate, illustrate, act out
- ***Involve students*** as much as possible –
  - Use them as examples
  - Use their names, their favorite things
  - Have them demonstrate with you
  - Ask them to stand up, move around, etc
- Give them a reason for learning the math or for doing a particular task (such as lowest terms)*

"SHOW, DON'T TELL"

- Keep for reference in binder, notes

- Give 8-10 examples

- Simple to complex, sequencing

- Use positive, whole numbers first, then incorporate negatives, variables, and/or fractions (as applied to your level of instruction)

- Avoid using 0 and 1 and 2^2 (at first)

- BE PATIENT, please!*

"SHOW, DON'T TELL"

- **_Write it down_** – overhead, board, etc.
- Students need to see the spelling because many common words are pronounced the same or sound the same to ELLs. Observe:

right – write   **why – y**   **to – two – too**

do – due   **size – sides**   **cheat – sheet**

chair – share   **choose – shoes**   **find - fine**

sheet of paper – chile pepper*

Simplified Definition Examples: Textbook vs. Modified

- **Variable** – A quantity capable of assuming any of a set of values, or a symbol representing such a quantity.

- **Variable** – **a letter that represents a number**

- **Ratio** – A relationship between two quantities, normally expressed as the quotient of one divided by the other.

- **Ratio** – **compare two numbers***

Simplified Definition Examples:

- **Percent** – a way of expressing ratios in terms of whole numbers. A ratio or fraction is converted to a percentage by multiplying by 100 and appending a "percent sign" %.
- **Percent** – **a number compared to 100**
- **Domain** – **all values of x**
- **Range** – **all values of y**
- ✓ *Goal is for comprehension and simplicity first, accuracy and specifics second. ***

Simplified Definitions:

- *Practice making your own simplified definitions. "Factor"*

- **Try to use 6 common words or less**

- **Get only the main idea ("Tell me in one sentence what the movie is about."**

- **You can build upon basics to become more specific once students have the main idea***

Vocabulary Development

- Select one or two key words

- Ask questions to get attention, relate to ordinary life, relate to other useful words

- Speculate meanings or ask "If this means that, how do you say ____?"

- Build on knowledge of Spanish or first language, if applicable or practical

- Demonstrate/illustrate word

- Reinforce many, many times during the lesson (orally, written) and for days afterward*

Analogies in Math

- Students can better understand an abstract concept if it is paralleled to or related with a familiar, concrete concept

- You need to think about the mathematical concept and how it operates, then find an ordinary procedure that is similar in how it operates. It's not always easy or obvious, but practice helps the process.

Distributive Property and Factoring

The Distributive Property is an algebra property which is used to multiply a single term and two or more terms inside a set of parentheses. Take a look at the problem below.

2(3 + 6)

Because the binomial "3 + 6" is in a set of parentheses, when following the Order of Operations, you must first find the answer of 3 + 6, then multiply it by 2. This gives an answer of 18.

2(3 + 6)
    2(9)
    18

! Incorrect Method !

It would be incorrect to remove the parentheses and multiply 2 and 3 then add 6, as this would give an incorrect answer of 12.

2(3 + 6)
    2 * 3 + 6
    6 + 6
    12

Examine the expression below.

6(2+4x)

The two terms inside the parentheses cannot be added because they are not like terms. Therefore, 2 + 4x, the expression inside the parentheses, cannot be simplified any further. To simplify this multiplication, another method will be needed. This is where the Distributive Property comes in.

The Distributive Property tells us that we can remove the parentheses if the term that the polynomial is being multiplied by is distributed to, or multiplied with each term inside the parentheses.

This definition is tough to understand without a good example, so observe the example below carefully.

6(2 + 4x)

    now by applying the Distributive Property

    6 * 2 + 6 * 4x

The parentheses are removed and each term from inside is multiplied by the six.
Now we can simplify the multiplication of the individual terms:
12 + 24x

(REAL TEXTBOOK Explanation)

Algebra Connections via Grammar

- "Jose, what two things do you like to eat?"
- "I like to eat pizza and hamburgers."
- Write: Jose eats pizza and hamburgers.
- Ask class to create two sentences out of the one you wrote. They come up with "Jose eats pizza." and "Jose eats hamburgers."
- Ask what the difference is between the first sentence and the second two sentences.
- You have the same meaning, but different structures.

Algebra Connections via Grammar

- Repeat procedure at least 3 more times, selecting different students and different things for them to list: colors, cars, school subjects, sports, etc. Emphasize that the meaning is the same; the sentence structure is different.

- Juana likes cumbias and hip-hop.

- Juana likes cumbias. Juana likes hip-hop.

Algebra Connections via Grammar

Show the connections using a curved line:

Juana listens to cumbias and hip-hop.

Juana listens to cumbias.

Juana listens to hip-hop.

Algebra Connections via Grammar

- Write a simple expression with numbers:

3(2 + 4) Ask students what the operations are. They **must** know that 3 is multiplied.

Using the same format as the sentences, ask students to "translate"

3 (2 + 4)

3·2 + 3·4

6 + 12

18

Verify with order of operations:

3 (2 + 4)

3(6)

18 ☺

Algebra Connections via Grammar

- You can introduce a negative by asking a student to list something he likes and something he doesn't like. The sentence process is still the same.

- Juan wears blue but doesn't wear pink.

- Juan wears blue. Juan doesn't wear pink.

Distributive Property and Factoring Recap

- Relate to simple sentence structures
- Use student information to write sentences
- Rewrite to change the format, but not the meaning
- After several examples, switch to numbers
- After several examples with adding numbers, switch to subtracting numbers or negatives
- After several examples, include variables
- Progress to using x^2 if appropriate*

Solving Equations

- Reinforce concept of elimination by using opposite operation (or zeroing out)
- Fairness, equal treatment "paleta, paleta"
- LOTS of examples and practice
- Prove correctness of result
- Start simply, then progress to more difficult
- Start with single operation, then two, then multiple operations*

Simplifying to Solve Equations

- Sort laundry: separate whites and colors, put all whites on one side, all colors on the other side…translate to variables and numbers

v   # = v   #

$$6x + 8 = 2x + 40$$

v   v   =   #   #

$$-2x \quad = -2x$$

v   # = #

$$4x + 8 = 40$$

$$- 8 = - 8$$

$$4x \quad = 32$$

$$/4 = /4$$

$$x = 8*$$

Simplifying to Solve Equations

- Relate combining like terms on the same side of the equation and on opposite sides of the equal sign.

- LABEL the parts!

- SHOW how terms are "moved" legally, not just a shortcut. Students will figure out shortcuts on their own.*

The Importance of You, the Teacher, in the Classroom

➢ "Show, Don't Tell"

➢ Use visuals, patterns, and analogies

➢ Incorporate references to things they already know; word play

➢ Patience

➢ High expectations

➢ Respect, Reward, and Praise*

Non-Academic Issues of ELLs

- ➢ Know your students
- ➢ Social conversations
- ➢ Home visits
- ➢ Support within the school setting
- ➢ Future planning*

Parental Involvement of ELLs

➢ Lack of involvement does NOT equal lack of interest

➢ You must take the initiative

➢ Are they really welcome?

➢ Why don't they come to school?

➢ What if I can't communicate with them?

➢ It's still "Show, don't tell"*

"Hasta La Vista, Baby"

- I hope you have learned something new to try in your classrooms.

- Please make helpful suggestions if you have any.

- Feel free to contact me via e-mail with questions or comments, or for more ideas.

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