



Strategies for Teaching Mathematics to English Language Learners

Presented by

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Numbers Mathematics Professional Development

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About the presenter:

Beatrice Moore-Harris is an outstanding teacher and an excellent presenter. She has devoted her 25-year career in mathematics education to working with struggling students, especially in the area of mathematics. In demand as a speaker at state and national conferences, she has provided teachers across the country with practical strategies for teaching struggling students. She is a former member of the Board of Directors for the National Council of Teachers of Mathematics, member of the TEKS 6-8 writing team, and is the co-author of *Algebra I*, *Algebra II*, and *Mathematics Applications and Connections Courses 1, 2 and 3*.

"I hope that this professional development experience will provide you with practical strategies, ideas and tools you can use immediately. Our focus will be on providing the appropriate mathematics content, strategies, activities and methods that accelerate the learning of English Language Learners (ELL) students. I have used these methods with my students, and they really work!"

Beatrice Moore-Harris



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I. Goals

One of the performance goals of the *No Child Left Behind Act of 2001* (NCLB) requires ELL students to become proficient in English while reaching high academic achievement standards in reading/language arts and mathematics. NCLB also requires that ELL students participate in annual academic assessments in reading/language arts and mathematics, which are used to determine adequate yearly progress for schools, school divisions, and the state.

The goal of this professional development is to provide mathematics teachers with:

- a brief overview of second language acquisition theory
- information about cultural differences
- effective strategies for differentiating instruction for English Language Learners (ELL)
- strategies to align instruction with the TEKS in a manner which supports ELL
- opportunities to network and dialogue with colleagues



Agree or Disagree...

ELL Students learn English easily and quickly simply by being exposed to and surrounded by native English speakers.

When ELLs are able to converse comfortably in English, they have developed proficiency in the language.

In earlier times immigrant children learned English rapidly and assimilated easily into American life.

II. Second Language Acquisition Research

Learning a second language is a complex process that develops in predictable, sequential stages. This progression closely mirrors the stages children go through as they learn their first language (Krashen & Terrell, 1983). During the initial period of learning a second language, ELL students may experience a “silent period” during which they concentrate on comprehension and respond using non-verbal means of communication (Krashen, 1985).

With increased exposure to the English language, ELL students progress through several additional stages of language acquisition. Following the “silent period,” ELL students typically begin to produce one- or two-word responses and use short repetitive phrases. At the next stage, ELL students start to produce simple sentences and engage in basic dialogue. Within one to two years, ELL students begin to use more complex statements, can sustain longer conversations, and state their opinions. At the final stage of language acquisition, most ELL students can understand grade- level classroom activities, argue and defend academic points, read grade-level textbooks, and write organized and fluent essays (Krashen, 1982).

The chart below summarizes general behaviors of ELL students at each stage of language acquisition (Krashen, 1982).

Stage of Language Acquisition	Behaviors of LEP Students Silent/Receptive Stage
Silent/Receptive Stage <ul style="list-style-type: none"> ▪ 10 hours to 6 months ▪ 500 receptive words 	<ul style="list-style-type: none"> ▪ point to objects, act, nod, or use gestures ▪ say yes or no ▪ peak hesitantly
Early Production Stage <ul style="list-style-type: none"> ▪ 6 months to 1 year ▪ 1000 receptive/active words 	<ul style="list-style-type: none"> ▪ produce one- or two-word phrases ▪ use short repetitive language ▪ focus on key words and context clues
Speech Emergence Stage <ul style="list-style-type: none"> ▪ 1-2 years ▪ 3000 active words 	<ul style="list-style-type: none"> ▪ engage in basic dialogue ▪ respond using simple sentences
Intermediate Fluency Stage <ul style="list-style-type: none"> ▪ 2-3 years ▪ 6000 active words 	<ul style="list-style-type: none"> ▪ use complex statements ▪ state opinions and original thoughts ▪ ask questions ▪ interact in more lengthy conversations
Advanced Fluency Stage <ul style="list-style-type: none"> ▪ 5-7 years ▪ content area vocabulary 	<ul style="list-style-type: none"> ▪ converse fluently ▪ understand grade- level classroom activities ▪ argue and defend academic points ▪ read grade- level textbooks ▪ write organized and fluent essays

The five stages of language acquisition described above are a general framework for understanding how ELL students progress; however, language learning is an ongoing, fluid process that differs for every student. Students may move back and forth between stages depending on the academic demands of a lesson and the amount of participation required. For example, a ELL student may be functioning at the intermediate fluency stage when performing routine tasks or accessing previously learned skills. However, when the academic content is new and the student lacks adequate background knowledge or experiences, the student may regress to the prior stage (early production).

For language acquisition to occur, students must (1) receive understandable and meaningful messages that are a little beyond their comprehension level and (2) learn in an environment where there is little or no anxiety (Krashen, 1981, 1982; Vygotsky, 1978). Recognizing these two principles can assist teachers in creating a natural language learning environment in their classrooms.

Outlined below are five key elements of an effective language learning environment. Use of these strategies can assist all students in accessing the content material.

1) Comprehensible input – Teachers can make their language more comprehensible by modifying their speech, adjusting teaching materials, and adding context to lessons.

2) Reduced anxiety level – A student’s emotions play a pivotal role in assisting or interfering with learning a second language. Teachers can assist students by creating a comfortable classroom environment that encourages participation and risk-taking without fear of feeling embarrassed or foolish. (Krashen, 1981; Krashen & Terrell, 1983).

3) Contextual clues – Visual support makes language more comprehensible. For example, a lesson about fractions using manipulatives is more understandable than an explanation of the concept. Even social language is more comprehensible when context is added. For example, understanding a face-to-face conversation using facial expressions and gestures is easier than a telephone conversation (Cummins, 1981).

4) Verbal interaction – Students need opportunities to work together to solve problems and use English for real, meaningful purposes. They need to give and receive information and complete authentic tasks.

5) Active participation - Lessons that encourage active involvement motivate LEP students, engage them in the learning process, and help them remember content more easily.

Types of Language Proficiency

Another theory about language acquisition that can help teachers understand the challenges of ELL students is the distinction between social and academic language proficiency. Jim Cummins (1981) suggests that there are two types of language proficiency:

- 1) Basic interpersonal communication skills (BICS)
- 2) Cognitive academic language proficiency (CALP)

According to Cummins, ELL students generally develop conversational fluency (BICS) within two years of studying a second language; whereas, developing fluency in more technical, grade-appropriate academic language (CALP) can take from five to seven years depending on the student's age and level of native language literacy. Failure to understand the distinction between these two types of language proficiency can lead to false assumptions about a student's language ability (Cummins, 1984). For example, ELL students may be exited prematurely from direct English instructional programs because they appear fluent in conversational English; however, they lack the necessary academic language and reading and writing skills to succeed in mainstream content classes. Several more years of direct English instruction are required before the students are fluent in all four skill areas (listening, speaking, reading, and writing) necessary for academic success.

Factors that Influence Learning a Second Language

The pace at which an ELL student moves through the five stages of language acquisition and develops conversational and academic fluency in English depends on a number of influencing factors.

1. Age of student – Age affects second language learning in a number of ways.

- Many older language learners enter the second language classroom with prior knowledge and skills in a first language that can transfer to a second language. For example, students do not have to learn concepts such as division, reading, and taking notes if they already possess these skills in another language. However, older language learners need to learn the English vocabulary words to discuss and study the concepts they are learning in the second language (Cummins, 1981).
- Younger students often do not have as much prior knowledge and skills. If they have not learned a concept in their native language, it may take them longer to learn the new academic content than native speakers. These students are learning a new concept and the accompanying English vocabulary simultaneously.
- Older language learners are often more inhibited to speak in front of peers because they feel vulnerable about taking risks and making mistakes.
- Class discussions and the reading level of textbooks are more academically demanding for the ELL student at the secondary level than at the elementary level. As a result, it may take older language learners longer to achieve on grade level in content area classes.
- Younger students generally achieve native- like pronunciation more easily than older language learners.

2. Limited or interrupted schooling and literacy in a first language

Literacy in a first language can positively influence the process of learning a second language. ELL students who are literate in another language have more background knowledge and skills to draw on to support them in learning a second language. However, this is not the case for all ELL students. Some may enter U.S. schools with limited and/or interrupted schooling. Some may come from rural communities where literacy and schooling were not emphasized, while others may come from countries where political turmoil prevented them from attending school regularly.

These students face the additional challenge of learning appropriate school behaviors and expectations at the same time as they are learning English and mathematical concepts. Teachers can assist these students by explicitly modeling appropriate school behaviors such as: 1) raising their hand before speaking; 2) organizing a notebook; 3) working in collaborative groups; 4) lining up to leave the classroom and remaining in that line while walking through the hallway; and 5) remaining seated and quiet in the cafeteria or auditorium. Teachers can also assist these students by assessing their background knowledge before a unit of study to identify knowledge gaps and create experiences to build background knowledge that may be missing.

3. Family and home circumstances that bring students to the United States.

The circumstances that bring ELL students and their families to the U.S. vary greatly. Some students come from war-torn countries or refugee camps, while others follow their families to seek employment, join family members, or obtain a better education. The circumstances that surround a family's decision to move can greatly affect the emotional and psychological well-being of ELL students, thereby affecting their motivation level and academic achievement.

Think-Pair-Share...

After reading, take time to discuss the following with a partner:

- *What points do you agree with?*
- *What strategies do you have in place to address the concerns raised here?*
- *Do you feel these comments address all your students or just the ELL students?*

Meeting the Communication Need

Language minority students are often quick to develop the social language skills that enable them to communicate with their peers outside of the classroom. Within an academic context, however, this basic proficiency is inadequate because language minority students are inexperienced with or lack an understanding of the terminology and writing styles particular to a content area. These students may not be prepared to perform the higher order language and cognitive tasks required in rigorous academic content areas.

Source: Teaching Mathematic to Limited English Proficient Students, www.ericfacility.net/ericdigests/ed317086.html

III. Challenges for Teachers and Students

The table below summarizes some of the cultural, linguistic, and academic challenges associated with teaching and learning English as a second language.

Student Challenges	Teacher Challenges
ELL students must learn about U.S. cultural norms and behaviors.	Teachers can assist ELL students by: <ul style="list-style-type: none">▪ being knowledgeable of the cultures represented in their classroom.▪ understanding the impact of cultural differences on classroom behaviors and academic performance.
ELL students must: 1) learn the English language (for social and academic purposes), 2) learn new academic concepts in content-area classes, and 3) transfer already known skills and concepts into English.	Teachers can assist ELL students by: <ul style="list-style-type: none">▪ creating a comfortable classroom environment.▪ modifying speech.▪ integrating language and content instruction.▪ using instructional strategies that increase comprehension.▪ providing explicit instruction and practice in using academic vocabulary unique to a content area.▪ assessing LEP students' English comprehension and mastery of academic concepts.

IV. Cultural Differences

A. In the Classroom

Teachers can assist ELL students and avoid misunderstandings by becoming knowledgeable of their students' linguistic, cultural, and academic backgrounds. Students' cultural perspectives and experiences can greatly impact their behavior in the classroom, relationship with the teacher and classmates, and academic performance.

1. Cultural norms related to body language

ELL students often come from cultures that have different norms about interacting with other people. Teachers play an important role in fostering an appreciation for and respect of different cultural norms among students in a class.

Following are several examples of differing cultural norms:

- a. Eye contact: Some ELL students such as those from Middle Eastern, Asian, and/or African countries may avoid direct eye contact, especially with someone who is an authority figure, as a sign of respect. They may feel more comfortable looking down or away. This type of behavior should not be misinterpreted as evasive or disrespectful.
- b. Speaking distances: Some ELL students such as those from Latin American countries have differing norms about personal space. They may stand next to or speak face-to-face with another person at a closer distance than is commonly accepted in the U.S. This behavior can be perceived as an invasion of personal space and can lead to discomfort when students are working in pairs or small groups.
- c. Girls holding hands - In some cultures it is common for girls to hold hands with one another. Educating other students about this cultural norm can prevent students from being teased or ridiculed for their behavior.
- d. Styles of clothing – Some ELL students wear traditional clothing from their native country to school. They may come from cultures that require women to cover their heads, arms, and legs when in public. Other students in the school may not be accustomed to this type of clothing and need to understand the cultural reasons for wearing them.

2. Method of instruction used in U.S classrooms

Some ELL students are not familiar with collaborative activities and active learning, which are commonly used in U.S. classrooms. In many of their countries, the classroom instruction occurs in the form of a lecture or emphasizes rote learning. Students are not considered active participants in the learning process. Class work is generally completed

silently and independently. When designing lessons, teachers of ELL students need to consider the following issues:

- Vary instructional groupings (individual, pair work, small group work, and whole class instruction) often throughout a lesson. This gives all students an opportunity to work in a grouping that is most comfortable to them.
- Introduce collaborative work gradually to ELL students. First, let ELL students work in pairs, and then introduce small-group activities to them. It can be overwhelming and intimidating for an ELL student to speak in a group, especially if it contains primarily native English speakers.
- Consider gender and the ethnic, racial, and religious background of ELL students when designing collaborative groups. Some students have never been in mixed gender classes and/or may feel uncomfortable working with some ethnic groups.
- Consider grouping ELL students with native English speakers. Listening to and talking with a fluent speaker helps ELL students internalize the structure of the English language.
- Teach ELL students that collaborative learning is not acceptable during a test. Sometimes ELL students, new to the concept, may think they can ask a classmate to help on a test as well. In some countries it is considered acceptable to assist another student during a test. Failure to understand this cultural difference can lead to inaccurately assuming that an ELL student is trying to cheat.

3. Acculturation

Newcomers to the U.S. may experience a variety of emotions ranging from unhappiness, loneliness, homesickness, frustration, or anger during the first six months in a new culture. In addition to not speaking or understanding the native language, they are learning to live in a foreign culture (home and school). Even for students who have studied English before coming to the U.S., it is likely that their previous experiences will not have prepared them for being a student in a school in the U.S.

The process of acculturation (i.e. the process of adapting to a new culture) often follows the four stages described below:

- 1) Excitement and euphoria - Newcomers are initially excited about their new surroundings.
- 2) Culture shock - Newcomers begin to feel disoriented as they recognize cognitive and emotional differences in the new culture.
- 3) Recovery - Newcomers gradually accept the different ways of thinking and feeling in the new culture.
- 4) Acceptance - Newcomers adapt or assimilate to the new culture (Brown, 1994).

Following are some strategies that teachers may want to use to help the newcomer acclimate to a new culture and feel more comfortable in their new school environment:

- Foster an appreciation of and respect for cultural diversity among the students in the classroom.

- Assign buddies to ELL students. Buddies do not necessarily have to speak the same native language. Assigning a native English speaking buddy can often be just as effective. What is important is that the buddy is helpful, patient, and culturally sensitive to the new student. A buddy may be a high- level or low-level student. In addition to helping students during class, ELL students often need buddies to help them adjust to many basic routines in U.S. schools (i.e., using a locker, buying lunch in the cafeteria, finding the bus, understanding the bell system, etc.)
- Create predictable daily classroom routines (starting class, collecting homework, moving into groups, etc.) and visual/verbal cues so that ELL students will know what to expect. This will let ELL students focus on learning the content rather than exerting energy understanding the classroom behavior.
- Find ways for ELL students to give non-verbal responses (especially those in the “silent period”). Students can use flashcards, raise their hands, write or draw, nod their head, or point to an object to indicate comprehension.
- Put up note cards labeling common classroom objects.
- Learn how to pronounce the names of ELL students
- Incorporate ELL students’ cultural backgrounds and experiences into lessons and class discussions whenever possible. Ask ELL students to bring in items that represent their culture and show them to the class.
- Encourage ELL students to use bilingual and/or picture dictionaries.
- Let ELL students speak to one another in their native language at times throughout the lesson to clarify what they are learning and clear up misunderstandings. Explain to the rest of the class the reason why ELL students are speaking to one another in their native language. Failure to understand the behaviors of ELL students can lead native-English speakers to wrongly assume that the ELL students are talking about them.

B. Related to Mathematics

Mathematics can be particularly challenging to ELL students because mathematical knowledge consists of three components: linguistic knowledge, conceptual knowledge, and procedural knowledge.

1. Linguistic Knowledge: Mathematics is not limited to performing computations in isolation; it is dependent on the English language. Academic standards in mathematics require students to apply computational skills in a variety of real- life problem-solving situations, read and solve word problems, communicate their mathematical thinking, and collaborate with their peers to complete a task.

Mathematics has its own specialized language, grammatical patterns, and rules. While ELL students are learning English, they must also learn the unique meanings that some English words have in a mathematical context.

Following are some linguistic challenges that ELL students may encounter in classroom lectures, discussions, and textbooks.

In order to understand mathematics, students must:

- learn many content-specific vocabulary words (i.e., quotient, equivalent, divisor).
- know the meaning of many complex phrases (i.e., least common multiple, greatest common factor). Many complex phrases are not found in bilingual dictionaries. Often times, ELL students will break apart the phrase (i.e., least common multiple) and look up each individual word in a bilingual dictionary to try to understand the meaning of the phrase. ELL students may not get an accurate translation using this strategy.
- understand that many common English words have unique meanings in mathematics (i.e., bring down, tree, face, plane, cone, net, positive, negative).
- understand that prepositions (i.e., by, with, to, into, from, etc.) are used in a variety of ways in word problems to signal operations.
- know the meaning of prefixes and suffixes (i.e., hept-, tri-, bi-, poly-, -gon, -lateral).
- understand unique mathematical sentence constructions (i.e., If $x = 5$, then ...).
- understand statements and questions that are written in passive voice (i.e., twenty is divided by five)
- know that mathematical operations are associated with many different words.

EXAMPLES:

Addition: add, plus, and, combine, sum, total of, more than, increased by, greater than

Subtraction: subtract, minus, less, less than, fewer than, decreased by, difference, lower, take away, from, shorter

Multiplication: multiply, times, product, as a factor, twice, double, triple, groups of

Division: divide, divided by, quotient, separated into equal groups, shared equally, over, into, how many groups

Equal: is, are, result, make

2. Conceptual Knowledge: Mathematics requires a conceptual understanding of a mathematical process in order to choose the correct operation(s) and perform the necessary steps to derive an answer. Some mathematical concepts can be very concrete, while others are abstract. To help ELL students succeed in the mathematics classroom, teachers need to connect previous knowledge and experience to new concepts that are being taught.

A ELL student may have learned the mathematical concept in a native language but may not have the English language development to understand a discussion, read a textbook, or be able to express his or her understanding. In this case, the ELL student does not need to re-learn the concept but must learn new English words to talk about a previously learned concept.

If the mathematical concept is new to the ELL student, then the teacher must make the instruction more concrete, visual, collaborative, and hands on.

A more detailed description of effective instructional strategies for teaching mathematics to ELL students can be found in Section VI of this document.

3. Procedural Knowledge: Just as one mathematics textbook differs from another textbook in its approach to teaching a concept, various cultures around the world

approach computation using different methods. This can cause tremendous frustration and often confusion for ELL students.

Following are some procedural challenges that ELL students may encounter in classroom lectures, discussions, and textbooks:

- ELL students may be accustomed to reading and writing from right to left instead of from left to right. The teacher needs to explicitly teach the ELL student the expected procedures for using a notebook and completing homework problems.
- ELL students may have learned a different way to write letters and numerals (0-10). For example, ELL students may draw a line through the stem of a 7 or add a serif to a 1. The teacher needs to show ELL students the expected method to write letters and numerals to avoid misinterpretations when reading homework or answers on tests.
- Periods are used instead of commas in some cultures to separate multiples of a thousand (i.e., 1,200,000 could be written as 1.200.000 in some cultures).
- Commas are used instead of decimal points in some cultures (i.e., 7.5 could be written as 7,5 in some cultures).
- Most ELL students are familiar with the metric system but have never studied the U.S. customary system. Students may have difficulty estimating length, weight/mass, and liquid volume using units of measurement that are new to them (inch, foot, yard, ounce, pound, cup, quart). They may also have difficulty understanding the use of fractions in measurements (i.e., half a foot, quarter of an inch). The metric system does not use fractions with measurement in this way (i.e., 5 millimeters is not described as half a centimeter).
- Many ELL students are not familiar with the U.S. monetary system and can have difficulty understanding word problems related to money. They may also have different ways of writing amounts of money (i.e. \$15.00 could be written as \$15,00 in cultures that use commas instead of decimal points).
- Some ELL students learn to add, subtract, multiply, and divide using different computational methods than commonly taught in U.S. schools.

Without a clear understanding of how mathematics in U.S. classrooms can be culturally different and challenging for ELL students, teachers may make false assumptions. A teacher may assume that a student that uses a period instead of a comma to separate the thousands place when writing a number is making a careless error when, in fact, in the student's home country, he/she has written the number correctly.

Teachers of ELL students can assist the students by:

- being aware of cultural differences so they can understand academic behaviors and performance in the mathematics class.
- explicitly teaching ELL students the class expectations about writing in notebooks (from front to back), completing homework assignments (from left to right), and solving computations using the procedure taught in class.

V. Strategies for Teaching Mathematics to ELL Students

For ELL students who are still acquiring academic English, it is essential that teachers integrate the study of academic vocabulary and grammatical structures while simultaneously building mathematical concepts.

It is critical to integrate language and content instruction because:

- students learn a second language more successfully when instruction focuses on academic content rather than linguistic form (Crandall, 1987).
- studying English in isolation without also learning grade-level concepts can delay an ELL student's academic progress.
- language acquisition occurs when input is meaningful and understandable (Krashen, 1981; Krashen, 1982).
- lessons that use concrete objects, graphics, manipulatives, and hands-on activities clarify and reinforce new concepts (Crandall, 1987).

To increase comprehension and make mathematics more accessible to ELL students, teachers may want to use a variety of strategies:

A. Classroom Management Strategies

- Create predictable classroom routines (starting class, collecting homework, working in groups) so that ELL students will know what to expect. By knowing the predictable routines, ELL students will not have to exert energy understanding classroom behavior. Instead, they can focus their energy on learning the content.
- Use consistent formats for assignments, worksheets, and tests.
- Seat ELL students purposefully (near the teacher or next to a buddy).
- Foster an appreciation of and respect for cultural diversity among the students in the class. Give ELL students opportunities to share stories about their country and culture and teach words from their native language. Decorate the classroom with items from their cultures.
- Write legibly and in print. Some ELL students may not be familiar with cursive and/or the Roman alphabet.
- Give directions step-by-step (orally and in writing) before assigning students to do independent, pair, or group work. Ask a student to repeat the directions aloud for the rest of the class to assess whether all the students understand the assignment.
- Give ELL students more time to process questions and formulate an answer. They have to think about the question in their native language and then work to find the English words to produce an answer in English. An ELL student's hesitation to raise his/her hand to answer a question should not be misinterpreted as shyness. ELL students often have the ability to reason and understand concepts at a much deeper level than they have the vocabulary to express. To reduce the pressure on ELL students, let them discuss a question in pairs for a minute before calling on a student to give an answer. This strategy gives everyone in the class more time to think about the question and form an answer. It also increases comprehension and gives all students more opportunities to participate in class discussions.

- Allow ELL students to talk to a peer in their native language when necessary to clarify understanding and clear up misunderstandings.
- Keep picture dictionaries in the class and allow ELL students to use bilingual dictionaries.

B. Instructional Strategies that Increase Comprehension

Integrate language and content

- Teach mathematical vocabulary (i.e., estimate, measure) and language structures daily.
- Teach students strategies to learn and study new vocabulary (i.e., vocabulary section in mathematics notebooks, class word wall, student- made bilingual dictionaries, and/or flashcards on spiral bound index cards with definition, examples, word used in a sentence, picture/diagram, or a native language translation).

Sample flashcard:

Word	Definition
Real world use	Illustration

- Integrate the four language modes (listening, speaking, reading, writing) into mathematics class.
- Model the process. Talk aloud while solving problems on the overhead or chalkboard to show the thinking process and common errors.
- Have students explain their thinking process aloud to a classmate while solving a problem.
- Integrate reading and writing through the use of journals, learning logs, poems, literature, etc.
- Give explicit instruction and practice in reading and writing word problems. Teach students to identify key words in word problems that indicate a certain mathematical operation.
- Begin class with warm- up activities using mathematical language to give students practice in sentence construction. - Write a cloze exercise (a short paragraph with key words missing) or sentence starters (i.e., Perimeter is the...) on the board for students to copy and complete when they enter class. - Give students a computation problem to solve, and then have them write the steps they used to solve it in complete sentences.
- Post labels and vocabulary cards around the classroom on completed word problems, number lines, rulers, fraction diagrams, and/or objects in the class.
- Have students paraphrase and write complex concepts in their own words (individually, pairs, or whole class).
- Review mathematical vocabulary and concepts using games such as TIC TAC TOE, BINGO, Concentration, Charades, etc.

Use a variety of modes of instruction

- Design multi- sensory lessons (visual, auditory, tactile, kinesthetic).
- Use visuals whenever possible to reinforce auditory instruction (i.e., charts, graphs, manipulatives, diagrams, models, real objects).
- Use graphic organizers to visually represent mathematical concepts.
- Design hands-on activities.
- Vary groupings throughout the lesson (i.e., independent work, pair work, small groups, whole class).
- Use real- life problem-solving situations to teach new concepts.
- Make interdisciplinary connections whenever possible.

Tap prior knowledge

- Connect students' prior knowledge and experiences to new learning. Find out what students already know about a topic by making a semantic web on the board. Write the topic in the center of a circle and record students' knowledge around it.
- Integrate ELL students' culture into lessons whenever possible. Give students opportunities to share examples from schools in their country and different ways of learning mathematics.
- Begin a unit of study by eliciting students' own questions about a topic.

Modify speech

- Enunciate clearly and slowly without speaking louder.
- Pause between sentences or thought groups.
- Use gestures and visuals to help clarify the message.
- Avoid using idioms and slang words.
- Use key words frequently.
- Repeat, rephrase, and paraphrase.
- Simplify the language used rather than the mathematical concepts taught (use known vocabulary and simple sentence constructions).
- When ELL students speak, focus on their message rather than their grammatical skills and accuracy. Respond using the proper grammatical form rather than overtly correcting their mistakes.

Encourage active learning and verbal interaction

- Design hands-on activities.
- Design meaningful and authentic collaborative activities to increase verbal interaction between students.
- Assign roles to students in collaborative activities. Discover the strengths of ELL students and assign appropriate roles.
- Initiate discussions that are based on real-world mathematical situations.

Teach organizational skills

- Demonstrate how to read a mathematics textbook.
- Point out key sections and resources in the textbook.
- Teach students how to organize notebooks and binders and record homework assignments.
- Teach mnemonic devices that assist memorizing content.
- Teach study and test-taking skills.
- Teach note-taking skills. For beginner ELL students, copying notes is an effective way to begin learning writing conventions.

C. Assessment Strategies

Before instruction

- Use daily warm-up activities to assess mastery of concepts from the previous day's lesson.
- Assess ELL students' knowledge before beginning a unit of study to learn where students have gaps in their learning and avoid unnecessary re-teaching of concepts. Some good techniques are semantic webbing and recording students' comments on a KWL chart.

During instruction

- Use a variety of assessment methods to measure English comprehension and mastery of concepts (drawings, charts, demonstrations, diagrams).
- Do quick checks for understanding every day (i.e., thumbs up/down, write answers on wipe boards at desks, hold up manipulatives).
- Observe and record ELL students' participation in small group activities.

After instruction

- Find alternate ways other than written tests for ELL students to show their comprehension (i.e., oral tests, diagrams, drawings, demonstrations).
- Give ELL students (especially beginners) alternate ways to participate in whole-class discussions and respond to questions (think/pair/share, flashcards to raise over head, hand and/or body movements, individual chalkboards for solving computations).
- Assess whether ELL students have mastered mathematical concepts rather than their English grammar and fluency.

VI. ELL/LEP Resources

Center for Applied Linguistics – <http://www.cal.org>

This Web site contains links to the latest articles, research projects, and publications in the field of second language acquisition.

Center for Applied Linguistics (CAL) Resource Guides Online

<http://www.cal.org/resources/faqs/RGOs/index.html>

The Resource Guides Online contain links to digests, books, listservs, Web sites, and ERIC documents related to teaching LEP students.

Cole, Robert W. (Ed.). (2001). *More Strategies for Educating Everyone's Children*.

Alexandria, VA: Association for Supervision and Curriculum Development.

Culture Grams – <http://onlineedition.culturegrams.com/world/index.php>

This Web site contains general information about countries around the world.

Viewers can subscribe to an online database and download Culture Grams that contain more detailed information about a country's history, people, and customs.

ESL/Bilingual Resource Guide for Mainstream Teachers -

http://www.pps.k12.or.us/curriculum/PDFs/ESL_Modifications.pdf

This guide, developed by Portland Public Schools in Oregon, contains a chart outlining the stages of language acquisition and several lists of useful tips for teachers of LEP students.

Help Kits produced by the Eastern Stream Center on Resources and Training (ESCORT)

<http://www.escort.org/>

These resources explain some of the cultural differences that teachers may encounter when teaching LEP students in mathematics, English, science, and social studies. It also contains instructional strategies and techniques and sample lessons adapted for teaching LEP students.

National Clearinghouse for English Language Acquisition (NCELA) –

<http://www.ncela.gwu.edu>

This Web site is funded by the U.S. Department of Education Office of English Language Acquisition and contains extensive print and Web resources related to LEP students.

Reed, B., & Railsback, J. (2003). *Strategies and Resources for Mainstream Teachers of English Language Learners*. Northwest Regional Educational Laboratory.

<http://www.nwrel.org/request/2003may/textonly.html>

Teachers of English to Speakers of Other Languages (TESOL)

<http://www.tesol.org/index.html>

VII. Mathematics Resources

Buchanan, K. & Helman, M. "Reforming Mathematics Instruction for ESL Literacy Students". NCBE Program Information Guide Series, Number 15, Fall 1993.

<http://www.cal.org/resources/digest/buchan01.html>

FAST Math curriculum (produced by Fairfax County Public Schools) –

<http://www.fairfax.k12.va.us>

This compacted mathematics curriculum, developed by teachers in Fairfax County Public Schools, contains lessons, activity sheets, and extension activities for teaching literacy skills and mathematical concepts to LEP students in grades 4-12 who are performing two or more years below grade level in mathematics.

The curriculum has two components: 1) an elementary level that covers objectives for grades 1-6, and 2) a pre-algebra level that covers objectives for grades 7 and 8. The curriculum integrates the study of mathematics and English vocabulary and relies heavily on hands-on and collaborative activities using mathematics manipulatives.

School divisions can order the FAST Math curriculum on CD-ROM for \$5.00 by contacting:

National Clearinghouse for
English Language Acquisition (NCELA)
2121 K Street, N.W.
Suite 260

Washington, D.C. 20037

202-467-0867

800-321-6223

Multilingual Handbooks

Various educational publishers produce multilingual handbooks that contain translations (Cambodian, Cantonese, Haitian Creole, Korean, Spanish, and Vietnamese) of some of the most common mathematical terms.

National Council of Teachers of Mathematics (NCTM) – <http://www.nctm.org/> and http://my.nctm.org/store/ECat/product_search_quick.asp?Run=1&search=changing+the+face

Changing the Faces of Mathematics: Perspectives on Latinos

Changing the Faces of Mathematics: Perspectives on Asian Americans and Pacific Islanders

Changing the Faces of Mathematics: Perspectives on Multiculturalism and Gender Equity

Todos: Mathematics for All - <http://www.todos-math.org/resources.html>

This Web site contains a collection of resources for teaching mathematics to Latino/Hispanic students.

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