

Pedagogy of Mathematics for the English Language Learner:

A Quick Start Teacher Training
Module



Developed by Sul Ross State
University:
A Member of the Texas State
University System

- o Funded by a grant from the Texas Education Agency
- o Based on an extensive review of the literature and research related to English Language Learners.



The Quick Start Module is Aligned With the MELL Classroom Practices Framework (CPF)

- o The CPF is a synthesis document which was compiled by members of the TSUS MELL Initiative.
- o The CPF document may be viewed at the MELL website www.tsusmell.org.



The Dual Language TAKS Practice Problems for this Module were Developed by Lamar University

- o Dr. Kyehong Kang wrote the software and Sunmee Kang provided the graphics for the dual language TAKS problems used in this module. B. Joanne Baker wrote the problems and Julie Rodriguez did the translations plus the voice-overs in Spanish.
- o A web link to MathNerds (www.mathnerds.com), a dual language homework help website for students, was also provided by Lamar University. MathNerds was created and developed by Dr. W. Ted Mahavier of Lamar University, and Dr. Valerio De Angelis from Xavier University in Louisiana.



Education 5100: Pedagogy of Mathematics for the English Language Learner

- o The teacher interested in earning one hour of graduate credit toward a Masters Degree in Education may sign up to take this class from Sul Ross State University.
- o A non-credit professional development course will also be offered which will provide hours toward continuing education.



Education 5100:

- o This course is presented using Asynchronous Web Delivery. There are no class meetings at school or on the Internet.
- o There are assignments, quizzes, and tests which will be e-mailed to the instructor.



Learning Atmosphere and Physical Environment

- o This article, as well as related articles, may be accessed through blackboard.
- o Some important features include:
 - o A caring atmosphere of mutual respect and support is the foundation for the safe, risk-free, collaborative learning environment schools strive to provide for students.
 - o Classrooms that contain culturally rich learning materials offer the scaffolding required for ELL students to find relevance in the instruction.



Learning Atmosphere and Physical Environment (Continued)

- o Students need an environment that encourages self-expression and provides positive recognition of who they are as unique individuals.
- o The most effective classrooms are those which build student confidence and self-esteem while still maintaining high academic and behavioral expectations.
- o Classrooms that are bright, colorful and include a variety of thought provoking images and sayings prove to be the most stimulating rooms, thus leading to the most brain activity and academic growth.



Learning Atmosphere and Physical Environment (Continued)

- o For ultimate learning, information should be relevant and have real world application.
- o The classroom should reinforce math-specific vocabulary and concepts using a variety of instructional strategies.
- o Organizational structures designed to help scaffold new knowledge are important.
- o Moore and Dwyer (1997) found that color-coding instructional materials significantly increased the academic performance of students.
- o The classroom designed to facilitate student interaction and group work will support student learning.



Instructional Practices

- o This article, as well as related articles, may be accessed through blackboard.
- o Some important features include:
 - o Four keys for academic success, Freeman and Freeman (2003)
 - o Engage students in challenging, theme-based curriculum to develop academic concepts
 - o Draw on students' background experiences, cultures, and languages
 - o Organize collaborative activities and scaffold instruction to build students academic English proficiency
 - o Create confident students who value school and value themselves as learners



Instructional Practices (Continued)

- o Use instructional practices that foster cooperation and collaboration
- o Cooperative learning characterized by (Kagan, 1986):
 - o The use of small groups of three or four students
 - o Focus on the task to be accomplished
 - o Requires group cooperation, collaboration, and interactions
 - o Supports fair division of labor



Instructional Practices (Continued)

- o Instructional practices designed for the mathematics classroom must include multiple representations that guide students through three levels of math learning: (a) concrete, (b) semi-concrete, and (c) abstract
- o The use of manipulatives and advanced graphic organizers benefits both ELL students and all students



Instructional Practices (Continued)

- o Master teachers might approach content from a concept-oriented constructivist method. Tenants of constructivism include:
 - o Learning is dependent on the prior concepts the learner brings to the experience
 - o The learner must construct his or her own meaning
 - o Learning is contextual
 - o Learning is dependent on the shared understanding learners negotiate with others



Instructional Practices (Continued)

- o Effective teaching involves understanding students' existing cognitive structures and providing appropriate learning activities to assist them
- o Teachers can utilize one or more key strategies to facilitate conceptual change depending on the congruence of the concepts with student understanding and conceptualization
- o The key elements of conceptual change can be addressed by specific teaching methods
- o Greater emphasis should be placed on “learning how to learn” than on accumulating facts (Anderson et al., 1994; Davis, Masher, and Noddings, 1990)



Instructional Practices (Continued)

- o Other instructional practices might include the use of information from:
 - o Gardner's (1993) Multiple Intelligences
 - o Sternberg's (1985) analytic, practical and creative intelligences
 - o Griggs and Dunn's (1996) culture-influenced preferences
 - o Tomlinson's (2001) gender-based preferences



Mathematics Content and Curriculum

- o This article, as well as related articles, may be accessed through blackboard.
- o Some important features include:
 - o The bilingual mathematics classroom must be a language rich environment. The language is not just words or numbers, but a language unique in its terms, phrases, way of talking, use of tools and objects (Pimm, 1987)
 - o Some activities that should be included in the classroom are mathematics diaries, graphic depictions, symbolic representations, word walls, manipulatives, and games which can aid in the acquisition of mathematical language.



Mathematics Content and Curriculum (Continued)

- o Course content should be delivered at the appropriate grade level and aligned with state knowledge, skills and professional standards.
- o Content should be based on diagnosed student needs since successful problem solving depends on the student's basic knowledge of facts, procedures and strategies.
- o The teacher should modify materials and guide the student so that they are structured to remain in the student's zone of proximal development to encourage the most rapid progress (Schrunk, 2004)



Mathematics Content and Curriculum (Continued)

- o Content should be designed to incorporate increased complexity by beginning a new concept with concrete examples and experiences and then provide opportunities for students to make connections between other concrete, semi-concrete, abstract, verbal and written concepts (NCTM, 2003)



Mathematics Content and Curriculum (Continued)

- o The strategies of bridging and scaffolding help to reduce math anxiety, provide a method for students to thoroughly learn concepts, provide an opportunity for the teacher to evaluate the student's understanding, and give the student more confidence (Palloway & Patton, 1993)
- o Curriculum should be challenging, relevant, age appropriate and well paced.



Mathematics Content and Curriculum (Continued)

- o Math teachers, according to Secada (1991), should know how their students mentally organize mathematical content, focus instruction on problem solving, determine what their students are thinking about the mathematical content under study, and design instruction based on their thinking.
- o Mathematics-specific vocabulary should be explicitly and implicitly taught and reinforced through repetition. Entire word families (i.e. pint, quart, and gallon) should be introduced using a variety of strategies including making models, displays, diagrams, and drawings. Colorful wall displays of mathematics vocabulary and concepts combined with the use of manipulatives and demonstrations reinforce the new and unfamiliar language of mathematics for not only ELL students, but all students.

Language Practices

- o This article, as well as related articles, may be accessed through blackboard.
- o Some important features include:
- o English Language Learners (ELL) have special needs when it comes to learning math (Brenner, 1994; Khisty, 1995; Roseberry, Warren and Conant, 1992)
- o Language support should be appropriate to age and grade level and presented in a socially meaningful context.



Language Practices (Continued)

- o Mathematics-specific vocabulary should be explicitly and implicitly taught and reinforced through repetition and presented by teachers who are knowledgeable about second language acquisition theories.
- o Ideally, dual language support should be offered for five to seven years, depending on student progress.
- o When dual language teachers are not available, the Sheltered Instruction Observation Protocol, SIOP model provides strong language support by addressing content through ESL.



Language Practices (Continued)

- o Research indicates there are distinctly different types of ELL students.
- o Oslen and Jaramillo (1999) divide students into one of the following categories:
 - o The first group consists of students who are recent arrivals who have had adequate formal schooling in their native country and have developed literacy in their first language.
 - o The second group are recent arrivals who have had limited formal schooling and who have not developed literacy in their primary language.



Language Practices (Continued)

- o The third group is students who have attended English-speaking schools for at least five years but have not developed literacy skills.
- o Each of these groups of students has different needs when it comes to instruction in content areas, particularly math.



Language Practices (Continued)

- o A student who speaks one language in social contexts and at home and is instructed in a second language in school does not have the deep level of second language proficiency necessary for true learning to occur (Ellis, 1985; Hakua, 1986; Berko Gleason, 1993; Collier, 1992a).



Language Practices (Continued)

- o The ideal instruction to support ELL students is a dual language model as defined by Hornberger (1990) as an enrichment bilingual/multicultural classroom environment where two languages are presented.
- o The dual language program supports the student linguistically by providing strict language separation, equality in language distribution, the avoidance of simultaneous translation, language taught through content, whole-language instruction, heterogeneous language grouping and has the goals of bilingualism and biliteracy



Language Practices (Continued)

- o The dual language model supports the student socio-culturally by promoting appreciation of cultural diversity, culturally relevant teaching, the development of self-esteem, mix of language minority with English-speaking and mainstream students, cooperative group learning structure, parental involvement, and strong school and community support structure (Hakuta & Diaz, 1984; Freeman, 1996; Torres-Guzman, 1990; Martinez-O'Brien, 1993; Cazabon, Lambert, & Hall, 1993; Krashen, 1987; Griego-Jones, 1994; Jacob & Mattson, 1995; Slavin, 1990; Crushner, McClelland, & Stafford, 1992;

Language Practices (Continued)

- o Research indicates that ELL students need five to eight years of dual language training to master academic language.
- o Student can master basic interpersonal communication skills (BICS) or social language by interacting with peers in formal and informal settings within a couple of years (Collier, 1987; Cummins, 1984) but this language is very different from the cognitive Academic language proficiency (CALP) required to master the language of learning academic subjects within the context of schools (Cummins, 1984).
- o Lack of CALP skills can often prevent the student who has the cognitive capacity to grasp material from fully comprehending content material without the contextual support of visuals, hands-on learning, gestures, and other non-verbal signals (Cummins, 1984).

Language Practices (Continued)

- o When dual language teachers are not available, the sheltered instruction model is the next choice.
- o Sheltered instruction is an approach that helps ELL students understand academic instructions presented in English.
- o One of the prominent features of sheltered instruction is that the ELL students are protected from competition with the native English speakers in a room with only other LEP students. (National Clearinghouse on Bilingual Education, 1987).



Language Practices (Continued)

- o Sheltered English Instruction classrooms support the ELL student by using physical activities, visual aids, and the environment to teach important vocabulary for concept development in content areas.
- o Teachers include extra-linguistic cues such as visuals, props, and body language (Parker, 1985); linguistic modifications such as repetition and pauses during speech (Parker, 1985); interactive lectures with frequent comprehension checks; cooperative learning strategies (Kagan, 1985); a focus on central concepts rather than details by using a thematic approach (Garcia, 1999; Moran, Tinajero, Stobbe, & Tinajero, 1993); and the development of reading strategies such as mapping and writing to develop thinking (Langer & Applebee, 1985).



Family and Community Involvement

- o This article, as well as related articles, may be accessed through blackboard.
- o Some important features include:
- o Research indicates that involving parents, other family members and/or guardians in the education of students facilitates learning in both the home and school (Volk, 1994; Axmita, et al, 1994; Henderson, 1987).



Family and Community Involvement (Continued)

- o Surveys show that most parents, regardless of their background, want guidance from the schools on ways to help their children learn better (Chavkin & Williams, 1989; Epstein, 1986).
- o Parents look to schools for help even if they do not or cannot make the first contact themselves.
- o Often, making the initial connection with families may be difficult due to language and social barriers.



Family and Community Involvement (Continued)

- o Sometimes, written and phone contact is not sufficient and parents are unable to visit the school due to significant problems with transportation and schedules.
- o Home visits demonstrate a commitment to communicating with parents that is critical when forging and maintaining relationships.



Family and Community Involvement (Continued)

- o Administrators and teachers need to collaborate with parents, becoming partners with them in the work of bridging the gap between home and school.
- o School administrators can lay the foundation for effective collaboration by developing ways to make parents more welcome in the schools.



Family and Community Involvement (Continued)

- o Teachers can help establish open dialog between home and school by making sure that parents understand the assignments their children are being asked to do and why.
- o They can tell parents what the goals are for the class, what the school's homework policy is, and what kinds of books or activities the parents can use to help their child at home.
- o Parents do not need degrees in mathematics or engineering to help their children with math.

Family and Community Involvement (Continued)

- o They can start by turning off the TV and making sure homework is done. When parents monitor homework, students complete more assignments, have higher test scores, and improve their grades (Kober, 1993).
- o There is a high correlation between students' mathematics achievement and limited television viewing (Mullis, Dossey, Owen, & Phillips, 1991).
- o Many schools and communities sponsor homework hot lines, tutoring, parent workshops, and programs to help parents assist their children with mathematics homework.



Family and Community Involvement (Continued)

- o LEP children are more likely to succeed academically if their parents actively support their learning.
- o They can (a) provide "a home environment that supports children's learning needs; (b) volunteer in the schools as aides or in other roles; (c) monitor children's progress and communicate with school personnel; and (d) tutor children at home to reinforce work done in school" (Simich-Dudgeon, 1986, qtd. in Weinstein-Shr, 1994).



Family and Community Involvement (Continued)

- o In addition, "children's achievement in school has been demonstrated to be directly correlated with the mother's level of education," as mother is usually the first teacher (Sticht, 1988, qtd. in Weinstein-Shr, 1994).
- o Weinstein-Shr (1994) cites research that shows how parent-child interaction affects student learning and how such interaction is especially valuable where literacy in a foreign language is new to both parent(s) and child.



Assessment of Student Learning

- o This article is currently under construction. When completed, it may be accessed through the blackboard course developed by Sul Ross State University.
- o Only limited evidence addresses the validity of tests with ELL students (Pennok-Roman, 1990).
- o Language-proficiency tests play an important role in the valid assessment of ELL students and educators often use these tests to identify students likely to benefit from bilingual education. (Duran, 1989)

Assessment of Student Learning (Continued)

- o Many language-proficiency tests are flawed as they commonly test students in a single modality—a paper-and-pencil test that ignores spoken and oral comprehension (Duran, 1989; Oller and Damico, 1991).
- o Figueroa (1990) has suggested using non-verbal tests of intelligence rather than English-language-dependent tests although such tests do not predict future educational performance as effectively as verbal tests.



Assessment of Student Learning (Continued)

- o An Annotated Bibliography on Assessment and LEP Students may be found at the following web site:

<http://www.ncela.gwu.edu/pubs/reports/highstakes/bibliography.htm>

