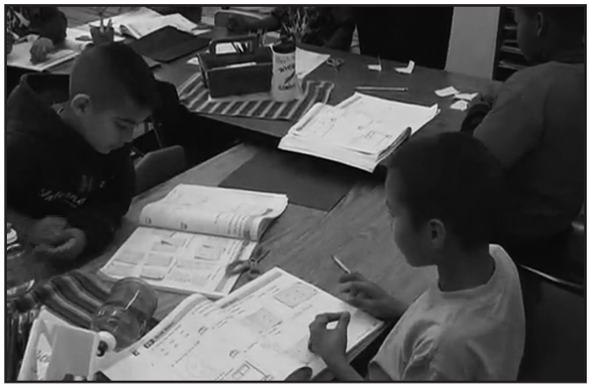
Scaffolding Language and Content Learning in a Core Mathematics Program

by Ruth Kriteman, Dee McMann, and Lisa Meyer-Jacks, DLeNM

Mathematics instruction, under the best of circumstances, can be challenging for both teachers and students—especially given the shift from memorizing algorithms to expectations for gaining and converying deep conceptual understanding. The language of math—with its content vocabulary, structures, and specialized use of everyday words—can easily challenge students as they listen, speak, read, and write in a mathematical context... even more so if they are working in a second language.

For the classroom teacher working to build conceptual understanding, mathematical literacy, and mathematical confidence in students with varied conceptual and linguistic backgrounds, these five key components of sheltered instruction can help to scaffold both content and language. (Karin Rich, *Making Connections*, Feb. 2001, *www.lcequity.com*)

Activate Prior Knowledge/Create Shared Knowledge—Good teaching includes activating students' schema and connecting new learning with previous experiences and knowledge. Sheltered instruction focuses on *creating shared knowledge within the classroom*. This could mean referencing previous learning in a spiral curriculum and/or keeping visual resources alive by referring to them repeatedly and fostering students' independent use. Intentionally planned questions and examples help students recognize their own related experiences; curricular routines and games/tasks require students to negotiate and create shared knowledge with peers.



First grade students use paper "crackers" to explore the concept of fractions and equal parts.

Use realia—We know that students learn best when they employ all of their senses and skills to learn. Sheltering makes great use of this technique by focusing on visuals, gestures, models, and other topic-related resources. Math instruction lends itself naturally to the use of manipulatives and actual "tools of the trade," while connections to real-life applications reinforce a sense of purpose and conceptual recognition. Students' informal talk about realia will move to more formal, academic language as they describe the processes and learning that occur during these hands-on activities.

Focus on Language—It takes an intentional focus on language functions and structures as part of every lesson plan and activity to help students navigate math language, concepts, and tasks. Kid-friendly analysis of directions, problems, solutions, etc., helps identify key structures, phrases, and math-specific vocabulary. Sentence frames for reporting out scaffold and elevate students' math language. Teacher modeling is key to a classroom where everyone talks like a mathematician!

Making Text Accessible—Good teaching leads students into, through, and beyond the text. Additionally, sheltered instruction focuses on pointing out and modeling the structure, particular linguistic features, and vocabulary of the genre students are reading or writing—including math. Student talk, guided by a language focus, helps students practice the necessary skills to make sense of text and apply it to their own thinking and writing. Teaching students how to use their math reference books, read a chart, or navigate word problems are examples of this component.

Structure Peer Interaction—Structuring the learning environment in a cooperative format where students will naturally negotiate meaning and respond to peer feedback puts into use the language structures described above. Frequent peer interaction in pairs or small groups provides the support, opportunity, and expectation for students to meet the language demands of their math tasks. Planned heterogeneous groups insure that both language and content models are present—and explicit, supported language expectations make the most of peer talk. Teaching and modeling how and why students support each other in these groups make it clear that helping each other is the classroom norm—and that everyone participates!

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The table below shows three scenarios that illustrate how these intertwined sheltering components might appear in the classroom.

		Components of Sheltering				
Grade Level: Math Program	*Description of Lesson*	*Activating Prior Knowledge and/or Creating Shared Knowledge*	*Supporting Meaning with Realia*	*Focusing on Language*	*Making Text Accessible*	*Planning for Peer Interaction*
1st Grade Everyday Mathematics: Unit 8, Money Transactions and Fractions	Students use paper crackers to explore the concept of fractions being equal parts. They divide the crackers into halves, fourths, thirds, … The activity is modeled whole class, and then students complete the activity at their tables.	• build chart of key concepts in front of students • discussion using a cupcake about what "equal parts" means	• cupcake example • chart with key vocabulary and sketches • paper crackers that students fold to test their ideas	• emphasize the difference between "hole" and "whole" • have the students repeat key vocabulary and sentences throughout lesson	• model the first problem in the practice book • class reads the rest of the page out loud together	• think-pair-shares (heads together) during whole group • partner support at tables
5th Grade Investigations: Unit 4, Fractions and Percents	Students review what they know about fractions, decimals, and percents. They create a chart that lists how these are used in everyday life.	• give students time to work together with a partner to look for examples of fractions, decimals, and percents	• pictures from magazines • measuring spoons for fractions • price tag for decimal example • sale advertisement to show percents	use sentence stems to help students report out: We use (percentages, decimals, or fractions) to _____. An everyday use of (percentages, decimals, or fractions) is to ___. ____is the same as ___. ___ is equivalent to ___.	• add sketches and pictures to go with text on chart • read ongoing assessment out loud to early language learners, sketch picture to go with word problem	• think-pair-shares during whole group • partner activity and share out to whole group
Middle / High School: Secondary Reform-Based Curriculum	Learning calculus through highly-contextualized problems: explore exponential functions through *Alice in Wonderland*.	• connect to biology: cell mitosis •connect to earth science: representing strength of earthquakes via Richter Scale (exponential growth in strength)	• sketching to provide a graphic representation of Alice's growth • use of a graphing calculator	•Teams must verbalize the equation y=x to the ___ power • differentiation of "to" and "two • ordinal numbers	• read excerpt from *Alice in Wonderland* in which she doubles in height for each ounce of cake she eats • discussion and clarification as teams determine how to sketch	•students work in teams to establish an equation to represent Alice's doubled height for each ounce of cake she eats