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Developing Conversational Language

Help English Learners Talk-to-Learn During Mathematics Lessons

RATIONALE FROM RESEARCH

Conversational language plays an important role in the mathematics classroom. The term refers to nonacademic language and usually is the first type of language acquired by second language learners (Cummins, 2000). Conversational language is sometimes referred to as "everyday language," "natural language," or "social communication." It includes informal language that students might use with peers or adults while playing, shopping, and completing household tasks. According to Cummins (2000), these Basic Interpersonal Communication Skills (BICS) are less cognitively demanding and are often acquired in 1 or 2 years. Using conversational language involves more than knowing words and grammar. Knowledge of sociolinguistic aspects of a language and styles of discourse also aid in communication. For example, knowing how to use politeness features of a language, how to catch listeners' attention, and how to change topics during a conversation are all language skills that are useful both in and out of the classroom. Green (2005) asserts that effective teachers "design learning activities to be challenging, engaging, relevant, and directed to student

motivations; emphasize the process of learning and its excitement as a quest" (p. 43). Learning is a social endeavor. Mathematics lessons can be structured so that they entice students to stretch and use the new language to communicate, especially when engaging, cognitively demanding tasks are presented. Learning includes talking in informal ways about ideas and making connections to familiar experiences and ideas, sometimes while using primary language (Moschkovich, 2009). Khisty (1995) describes the mathematics register as "a set of unique meanings and structures expressed through everyday language" (p. 282). Conversational language and development of the mathematics register serve as learning tools in the mathematics classroom, and mathematics lessons can lead to increased acquisition of English language skills.

The National Council of Teachers of Mathematics (NCTM) points out that conversational language makes it possible to teach children important formal mathematical terminology:

> Children need introductions to the language and conventions of mathematics, at the same time maintaining a connection to their informal knowledge and language. They should hear mathematical language being used in meaningful contexts. . . . Young children need to learn words for comparing and for indicating position and direction at the same time they are developing an understanding of counting and number words. (NCTM, 2000, p. 75)

■ MATHEMATICS TEACHING EXAMPLE

Geometric Attributes

Sorting Shapes

Get Ready

Work in your Group of Four.

Do

1. The Materials Person gets 8 or more cutout shapes.
2. Talk about how you will sort the shapes into two groups.
3. Sort the shapes into two piles.
4. Explain your answer to this question: "Why do these belong together?"
5. Be ready to show your teacher your work and tell about it.
6. Start over and sort again with a different sorting rule.

In this mathematics teaching example, students engage in informal conversation with peers while they learn about geometric attributes. In

Figure 1.1 Shapes to copy and cut out for sorting activities.

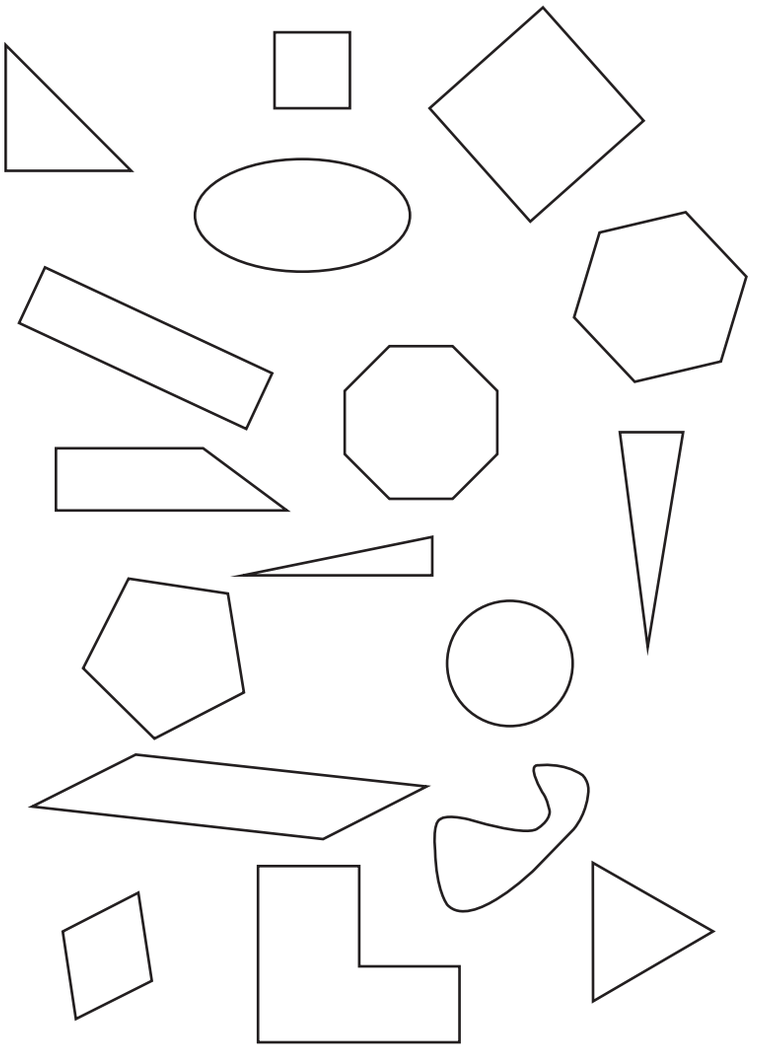

Illustration by Celia Stevenson.

NOTE: See the Appendix A1.1 on page 120 for the full-sized figure.

addition, students make use of their conversational language skills as they move toward learning academic language terms.

Ms. Wilson, a second-grade teacher who has many English learners in her class, has regularly had her students work and talk in small cooperative groups during their math hour. During the previous day's lesson, the students worked with the same set of geometric shapes. Each child got to pull a shape out of a bag and was asked to say, "My shape has. . ." in order to begin to build vocabulary to describe attributes of the shapes and as a precursor to emphasizing names such as "hexagon" and "oval."

To begin this lesson, students are seated on a rug at the front of the room. Trays of shapes have been set out at each group's table.

Ms. Wilson: I want you to think in your minds about the time we took a handful of objects from our box of "Treasures." We put them into piles and had reasons why they belonged in the different piles. Everyone, tell your neighbor what we called "putting into piles for a reason." What does it mean? …That's right, I heard people say, "sorting." [Ms. Wilson writes "sorting" on the board.] When we sort, we think about how some things are alike, why they belong together, and how the other things are different. That is our sorting rule.

Ms. Wilson: So, today you see the shapes that we used yesterday in the tray at your tables. I want you to go to your tables and work with your group. Here are two paper sorting mats to hold your sorted piles. One person will take a turn getting at least eight shapes. Work together to put the shapes into two piles and have a reason why the shapes in each pile belong together. [Ms. Wilson holds up a rectangle and a parallelogram and gestures.] For example, should I put these shapes in the same pile or in different piles? I could do it either way. I just need to have a reason why they are alike or different, and to talk to my group about it. I'll let you work on it a while. When I come around, I'll ask you what your reason is for sorting the way you did. Then I'll push them together again. [She motions with her hands.] Then, you can figure out another way to put them into piles with reasons.

The students work in their groups for about 15 minutes while Ms. Wilson moves among the groups to clarify the instructions as needed and to ask questions. She leaves a tape recorder running at Table 3 to capture the students' spontaneous conversation:

Laura (L): I can do it. [She begins to take a few shapes to make a design, but looks over at other tables.]

Daniel (D): The teacher said we put these in piles.

Ernesto (E): I like this one [holds up a thin parallelogram]. Racing car. [He pushes it along the table.]

L: My car fast.

Camille (C): This one's pointy. [holds up the isosceles triangle]

E: This baseball. [holds up circle]

Ms. Wilson: [to the whole class] Remember, you're sorting, putting the shapes into piles. So, talk at your tables about what you see, not what you could pretend. I heard someone say, "The circle is like a baseball," and that shows you have a good imagination. But, today we want to talk about how the shapes are alike and different. Think about what each shape feels like. When I hold this circle in my hand, how does it feel compared to this hexagon? Talk about it with your group.

E: It's sharp. [holds the hexagon in one hand and the circle in the other hand]

L: Goes like this. [runs hand around the circle and rolls it carefully] The ball rolling.

D: It's not a ball; it's flat, it's smooth.

C: Let's put all the smooth ones over here. [pushes the circle to one of the mats] Ernesto, put the pointy one over there. [points to the other mat]

L: What's about this one? [holds up the trapezoid]

E: Sharp. [touches finger to the tip of the trapezoid] Blast off spaceship! [He moves it through the air.]

D: It's pointy, too.

L: [holds the trapezoid in front of Ernesto] Ernesto, put it with pointy ones.

E: I do it. [moves the trapezoid to the mat with the triangle and the hexagon]

C: [picks up the equilateral triangle] This is pointy, too. Let's put all the pointy ones here.

D: Let me get some. I'll get some more pointy shapes. [He takes some of the other polygons and puts them with the "pointy" shapes.]

E: I get rolly ones. [picks up the curved shape and oval and puts them on the mat with the circle]

L: Look, mine is like rolly one. [puts the regular octagon on top of the circle]

E: [looks at Laura with puzzlement, and starts to take the octagon from Laura]

D: No, put it in the other pile.

C: It's not a box, Laura! But it goes over there.

E: Pointy ones. [puts the octagon with the polygons]

L: What left?

E: Pointy. [picks up the irregular hexagon and puts it with the polygons]

C: That one is a box! [points to the rhombus]

[Ms. Wilson comes over, seeing that they are just about finished with the sorting.]

Ms. Wilson: So, what have you got here?

E: Pointy ones here. [He points to the appropriate pile.]

C: We put the squares and triangles over here.

L: And round ones there.

Ms. Wilson: And what's the same about all these? How are they alike? [points to the mat with polygons]

L: All pointy. [points to each of the corners of the triangles]

Ms. Wilson: I heard many of you notice the corners, the pointy parts. We call these shapes "polygons" because they all are made with corners and straight sides—not like your other shapes. These [points to the curved shapes] are different from polygons, they don't have corners and they don't have straight sides. How many sides do these have?

D: You can't roll that one. [points to the irregular closed curve]

Ms. Wilson: That's true, but can you run your finger along the outside of the shape—do you come to a corner? Camille, try that—how many corners does the circle have?

C: It goes around and around.

Figure 1.2 Another group of students' sorting work, with differing opinions on where to place the regular hexagon.

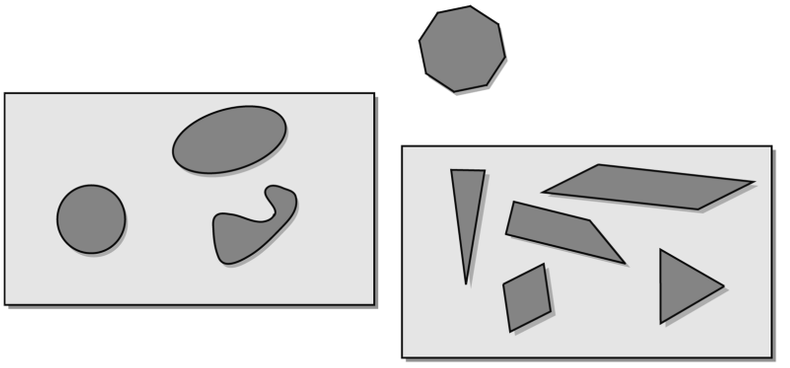

Illustration by Celia Stevenson.

Ms. Wilson:	Right, so we say it only has one side. You can count the sides on the other shapes. What about the corners on the shapes in your two piles? Do all of your pointy shapes have corners? [The students move the shapes about and agree that all the shapes on their second mat have corners.]
Ms. Wilson:	Great! Now, I'll push them all together and you start again and this time have a different way to sort—to put them into piles with a different reason. [Teacher moves the shapes together.] You're working well together and I am very interested to see what you'll come up with next. [Teacher moves on to another group.]
L:	I like the long ones. [takes rectangle and "long" right triangle and puts them in one pile]
	[The discussion continues.]

SOURCE: Discussion with Ms. Wilson from Coggins, Kravin, Dávila Coates, & Dreux Carroll (2007).

■ DISCUSSION OF THE MATHEMATICS TEACHING EXAMPLE

Connections to Common Core State Standards

Grade 2 » Geometry » Reason With Shapes and Their Attributes (2.G.A.1) "Recognize and draw shapes having specified attributes . . . Identify triangles [and] quadrilaterals."

Standard for Mathematical Practice 3: "Construct viable arguments and critique the reasoning of others."

Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. . . . Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

Mathematics Goals

The main mathematical goal in the lesson is to have students increase their awareness of attributes of shapes; for example, the existence of corners and straight or curved sides. The sorting activity helps students begin to notice properties, such as, "This has square corners," and informally define classes of shapes, for example, "These all have four sides." Formal vocabulary to describe attributes, such as *right angle* and *quadrilateral,* is necessary for more formal study of geometry, but cannot be learned until awareness of such properties has been developed, as Pierre and Dina van Hiele described in the 1950s (Chapin & Johnson, 2006).

Mathematical communication skills are fostered as students learn more about the meaning of sorting objects into two distinct groups and that a variety of sorting rules may be used for a set of objects. Students are learning to talk about mathematics by using conversational language to scaffold into formal mathematical language. They practice verbally justifying their decisions as to why certain shapes are grouped together.

Language Goals

Because the lesson is centered on active involvement, the teacher has many opportunities to model the expected structure, syntax, and vocabulary of conversational English and to use questions and sentence responses both during small-group and whole-class discussions. Clear language goals in this lesson are to have students speak and listen for the purpose of communicating. The activity provides a purposeful context for development of targeted conversational language. For example, students may make statements and ask questions such as, "I want to be first," "Put it in the other pile," "Where is my paper?" and "Please give me some shapes."

All learners begin to learn new math concepts, including the concept that shapes may have attributes such as angles, sides, curves, and faces, while using their existing knowledge and words, and possibly while speaking in their primary language. In this lesson, initial concept development and introduction of formal mathematical terms occur while using conversational language. Ms. Wilson models standard usage and formal terms, but she allows the students' conversation to go on without correcting students' choice of terms or lack of complete sentences; for example, students say, "Pointy"; "And round ones there." The teacher builds on students' knowledge of everyday English terms, such as *piles,* to explain the assignment, and the students use language that they know as they complete the assignment.

Math and language goals are intertwined. Ms. Wilson is conscious of the language that she uses and anticipates possible breaks in understanding. She demonstrates purposeful use of familiar words such as *treasures* to initially introduce the word *sorting,* and then she later uses the word *shapes* with *sorting.* She alternates between using the term *sorting,* and the class's definition, *putting into piles with a reason,* as she focuses attention on how the shapes are alike and different.

Students of Varying Language Proficiency Levels Working Together

In this lesson, English learners work with English-only students. The English learners vary from beginning to advanced English-language proficiency levels, and all participate. The game-like context sets students at ease and draws them in. The task is challenging and offers many possible ways of sorting. This gives the students many things to talk about in their small groups. Because the task involves objects that can be picked up and moved, some communication between students also occurs through gesturing. Making reference to a specific shape provides a context for understanding when a classmate says "sharp" or "pointy."

Interestingly, Camille appears to be searching for a general term to apply to all of the polygons when she refers to boxes. Her classmates do not pick up on this word, most likely because they are focusing on their own mathematical needs, and not because of any language barrier. Such a dialogue could easily occur in a group of fluent first or second graders.

Talking and Doing Help With Thinking

By hearing the other students refer to the "pointy" shapes, Ernesto becomes more aware of geometric attributes, particularly the existence of corners. Language, including both formal and informal terms, helps learners to think in new ways and to internalize their thought processes. Discussing, and even arguing, helps students clarify their thinking, solidify their understanding, and at the same time provides language development opportunities. For example, at the beginning of the lesson, Ms. Wilson says to the students, "Everyone, tell your neighbor what we called 'putting into piles for a reason.' What does it mean?"

Throughout the lesson, there are many specific ideas to see and discuss, because the lesson is centered around active involvement and concrete materials. For example, the students become more aware of curved and straight sides and of vertices (corners). They also go further to investigate similarities and differences between the octagon and a circle.

Developing Awareness of Attributes of Geometric Shapes

Through a group activity involving considerable use of conversational language, as well as manipulation of cardboard shapes, the four students with varying levels of English proficiency make considerable progress in expanding their awareness of attributes. Some of the students may not have ever focused on corners or curved sides before this activity. Interestingly, in spite of hearing comments about "pointy" shapes, it is quite possible that some students are still not aware of the existence of angles in the polygons, as students' geometric perception develops with increased experience (van Hiele, cited in Chapin & Johnson, 2006). But, the students all go beyond vague nonmathematical statements such as, "racing car " to describing attributes as a means of justifying their groupings. For example, in future lessons, they are likely to be able to say, with support, "These are all polygons because they are made with straight sides

that touch." Such statements eventually lead to the ability to make informal proofs.

Young children need to touch, move, and talk about geometric shapes in order to become aware of attributes. Worksheets with pictures of shapes do not lead to the same level of learning.

Related Example for Middle School Students

Middle school English learners, and all learners, benefit from structured work with peers, including the use of established class routines for interaction with one another. For example, when beginning a study of angles or similar figures, a teacher might give each group of four students a page of shapes similar to those in Figure 1.1. Groups could use a sentence starter such as "I notice that . . ." and then take turns writing descriptive annotations using their own words such as "lots of sides," "pushed circle," "big corners," "triangle on end of box," "same shape names, both squares," and possibly academic terms in English or native languages.

Such brief activities increase students' attention to attributes that will soon be formally named and used in other lessons. The initial activity also provides the teacher an opportunity to listen to group conversations and to use the papers as group preassessments of awareness of geometric attributes such as types of angles and number of sides and of geometric vocabulary.

Connections of Conversational Language to Standard for Mathematical Practice 3: Construct Viable Arguments and Critique the Reasoning of Others

All learners begin to learn new mathematical concepts while thinking and talking using their existing knowledge and words. English learners may explore ideas in their first language and can benefit from discussions with peers, as seen in this chapter's lesson example. Besides using words, young students "can construct arguments using concrete referents such as objects, drawings, diagrams, and actions . . ." (National Governors Association Center for Best Practices & Council of Chief State School Officers, 2012b). As is seen in this chapter's lesson, students can be encouraged to use their formal and informal language skills to ask questions, and to decide whether arguments made by peers make sense.

TEACHING TIPS ■

- Create a classroom climate where students' collaboration and conversation about mathematical ideas are valued and where students take turns speaking in a group and sharing their thinking.
- Teach students to listen to one another's ideas and to build on each other's statements. Post and model use of sentence starters such as, "I agree with Ali that there are . . .," "I'd like to build on Jenna's idea. . .," and "I don't understand what Kira meant when she said . . ."

- Teach students how to involve classmates with limited English proficiency in group work by using gestures, pictures, questions, and short, clear statements.
- Present small groups of students with pure and applied mathematics problems that provoke students' interest and naturally lead to discussion and to communication through the use of visual representations such as diagrams or manipulatives.
- Ask students whether they agree or disagree with a statement; ask them to compare and contrast two related ideas.
- Increase students' opportunities to speak during class by interspersing lessons with brief Think-Pair-Share sessions in which both partners express their ideas to the best of their abilities. For example, "Tell your neighbor how you found your estimate for this problem."
- Give groups of students specific ideas and questions to discuss with one another and also give suggested formats for reporting back. Alternate between asking for a group report and individual responses.
- Ask questions that address a variety of levels of thinking, including factual, application, analysis, synthesis, interpretive, and predictive questions so that students of varying language fluency levels have opportunities to both speak and listen.
- Develop the habit of adding at least 7 seconds of wait time after asking a question.
- Use routines and procedures for asking various students for their response so that all students get a chance to speak while no one is forced to do so.
- Allow mixed use of language (primary language along with English) during students' mathematics discussions.

Figure 1.3 Sample sentence starters can be provided to expand English learners' participation in class discussions.

- "I notice that . . ."
- "I agree with *(name)* that there are . . ."
- "I'd like to build on *(name)'s* idea . . ."
- "I don't understand what *(name)* meant when she said . . ."

Illustration by Celia Stevenson.

Figure 1.4 Tables and charts can teach organizational skills and also serve as a public record of words and ideas for English learners to talk about.

	Comparing Two Kids		
	Zach	***Rya***	
	brown hair	brown hair	*alike*
different	straight hair	curly hair	
different	glasses	no glasses	
	pants	pants	*alike*
different	T-shirt	buttoned shirt	
different	red sweater	blue sweater	

Illustration by Celia Stevenson.

Additional Tips for Secondary Teachers

- Explain to older students that talking about math ideas is a learning strategy that benefits understanding and remembering new concepts and new vocabulary.
- Incorporate into lesson plans frequent times for structured student-to-student discussion.
- Teach classes a variety of cooperative learning partner and group work routines, beginning early in the school year.
- Offer structures such as sentence starters and posted prompts.
- Set class expectations for student-to-student collaboration.

DISCUSSION OF CONVERSATIONAL LANGUAGE

Students' conversational language skills can be enhanced during mathematics instructional time. At the same time, the use of informal language can support mathematical learning. Mathematics lessons should be designed to purposefully add to students' English conversational language skills. This may include purposeful instructions to focus on language related to specific contexts such as using polite sentences to ask for things or instructions to use particular sentence frames during a lesson.

Promoting informal engagement in mathematical conversation is particularly useful in mathematics problem-solving lessons because it creates "social scaffolding" for English learners. Students can begin to be involved in higher-level mathematical work when a classroom culture and peers offer support from initial task comprehension to the exploration and investigation of different possible strategies and solutions. When small groups of students are left alone with a comprehensible, engaging task, the discussion goes in many directions, and the language used reflects whatever background knowledge the students have at that moment. Especially for English learners, the appropriate formal mathematical vocabulary must be layered on top of experiences, not presented abstractly.

Allowing students to use their primary language can help students at beginning levels of fluency sort out their ideas and remain engaged in learning the targeted concepts and skills. Mixed language use, when communicating complex new ideas, allows English learners to get their message across (Moschkovich, 2009).

Why is conversational language important in learning mathematics?

Students in school settings almost always acquire conversational language skills earlier than academic language. This language can be used to describe ideas and to ask questions during mathematics lessons. For example, when discussing a division word problem, a student might say, "They share; everyone get the same." Such language can help connect known ideas from everyday life, such as sharing items, to new math concepts such as division. Conversational language can also serve as an important tool in presenting mathematical arguments and making generalizations.

Discussing mathematical ideas supports the development of mathematical understanding. All students are encouraged to fully participate in lessons when a teacher establishes classroom norms and expectations for class discussions, helps everyone focus on the mathematical content of what is being discussed, supports students' attempts to speak up through rephrasing and clarifying, and builds on students' statements.

Conversational language also helps students interact with one another in the classroom, thus helping to engage English learners in learning activities. Additionally, English words and phrases that are useful both in and out of the classroom can be reinforced during mathematics lessons. Examples include *work together, fair, share, put away, pass out,* and *take turns.*

Why is a problem-solving approach to mathematics helpful to English learners' language development?

Problem solving involves more than one- or two-step word problems, or computation in context. It has been defined as figuring out what to do when you don't know what to do. Problem solving can provide a reason for students to strive to communicate in a second language (Dominguez, 2005). In spite of language challenges, grappling with nonroutine problems can be profitable both for language and for mathematics learning. Students engage in considerable linguistic activity and compare and contrast mathematical ideas as they work together to solve a problem. In addition, there are opportunities to deepen understanding as students are asked to defend their reasoning (e.g., "The reason I know my answer is correct is because . . ."); to extend the problem to find patterns, mathematical rules, or generalizations; and to discuss connections to other problems.

What are characteristics of effective prompts for stimulating conversational language?

Effective prompts are understandable, with accessible sentence structure and cultural relevance. They are motivating, challenging yet not out of reach, and have multiple ways of being represented and thought about. Easy tasks are often dismissed without much discussion, whereas prompts where the solution is not readily apparent are much more likely to lead to healthy arguments and counterarguments and verbal clarification of ideas. When a task lends itself to multiple representations such as tables, graphs, diagrams, and equations, students encounter a variety of ways of making sense and deepening their understanding.

Tasks may have some aspects that need to be clarified at the outset. Students may need some explicit help to enhance the motivational aspects that will intrigue and engage them, just as they may need some scaffolding to help them see connections to related situations and mathematical ideas.

Note that textbooks have interesting problems that can spark conversation in sections such as Problem of the Day, Thinker's Corner, Practice Problems, Extensions, and children's literature can also trigger ideas.

How can you ensure that all students will have a chance to speak and to ask questions?

This is a critical responsibility of the teacher and hinges on decisions regarding the establishment of classroom norms, use of questioning techniques, and training of students in specific classroom roles and working cooperatively with classmates. Classroom norms, or rules of conduct, should be established at the beginning of the year through classroom discussion, rehearsal, and practice and referred to regularly throughout the year.

Many teachers have found that when they retrain themselves to avoid repeatedly calling on the most eager students and to avoid giving praise after each student utterance, they are able to encourage the quieter students to join in and the most eager students to be respectful of their peers' ideas as well as their peers' needs to participate.

Some teachers use simple systems such as randomly pulling name-sticks from a container in order to invite students to speak up and to protect think-time (wait-time) for all students. More students have an opportunity to voice their thoughts when Think-Pair-Shares are used frequently to provide think-time for a moment, nonthreatening talk-time with one partner, and then sharing out with a larger group (Lyman, 2003). Also, small-group assignments to synthesize, or even to list the ideas of group members, provide opportunities for most or all students to speak up in a relatively nonthreatening setting.

Cooperative groups are used by many teachers as venues for increasing opportunities to speak and for taking turns with responsibilities and roles. They can give students a relatively low-risk chance to take turns leading a group, writing down a group's ideas, reporting back to the class as a whole, and so on. Students who are beyond the very beginning levels of language acquisition can take on a group responsibility and speak to their groupmates and class with the support of a buddy or an adult helper. It is important to clearly state expectations as to group organization, individual and group responsibilities, and planned format for showing results.

CONVERSATIONAL LANGUAGE RESEARCH ■

In an overview of research, Genesee, Lindholm-Leary, Saunders, and Christian (2005) found several strong benefits from the promotion of oral language skills in a second language. Not surprisingly, increased oral language skills are associated with increases in use of the second language and further increases in proficiency. Oral proficiency is related to the ability to use more complex language learning strategies, including interacting with others and monitoring speech, which can be of particular importance in the mathematics classroom. Also, higher-level question forms are used and the ability to define words increases when oral language skills are promoted.

According to Cummins (2000), students acquire language in phases. The first and easier phase is BICS. In this phase, students develop social

language skills. They may carry on a conversation with a friend, ask for directions, or play a game. BICS is typically developed within familiar, interactive, and uncomplicated contexts.

The second, and more difficult, phase is Cognitive Academic Language Skills (CALPS). CALPS includes much more than the learning of formal mathematics terms. It involves types of thinking and communicating that are uniquely found inside the school. In this phase, students use the language of the classroom. For example, they describe, compare, justify, or synthesize content information and use academic vocabulary.

Traditionally, mathematical academic language skills have been taught during instruction on cognitively demanding new concepts and skills, through context-reduced communicative activities (Chamot & O'Malley, 1994). In addition, Gersten and Baker (2001) point to research showing the very limited amount of class time that is spent speaking or writing in English, even in English Language Development classrooms. Teachers of English learners are now changing their mathematics instruction to increase overall use of both conversational and academic language and to make instruction more accessible through the use of a variety of strategies, as described in this book and others (Herrell & Jordan, 2004). One strategy is for the teacher to monitor and adjust his own speech so that the pace and sentence structure make students' comprehension more likely (Echevarria, Vogt, & Short, 2004).

Krashen and Terrell (1983; Krashen, 2002) contend that having opportunities for purposeful use of language supports its development and expansion in a natural way. Models have been developed in response to the argument that English learners need frequent opportunities to express complex ideas in English. These include the Instructional Conversation Model, Complex Instruction, and Brenner's Communication Framework. The Instructional Conversation Model not only promotes considerable use of oral language through teacher questions and statements, but its primary purpose is to teach complex concepts and to develop learning habits such as analysis, reflection, and critical thinking (Goldenberg, 1991; Khisty & Viego, 2005). The Complex Instruction model based on the work of Edward de Avila and Sharon Duncan has students working in groups as they complete tasks. This peer-to-peer teaching and learning model was further developed by Elizabeth Cohen (1994). Brenner's (1994) Communication Framework encourages students to discuss, argue, and communicate about mathematics.

Cooperative learning groups have been used extensively in language arts instruction for decades (Kagan, Kagan, & Kagan, 2000; Nelson, 1996) and in science (Cohen, 1994) but have not been as extensively researched with English learners and mathematics (Siegler, 2003). Cohen (1994), Cohen and Lotan (1997), Johnson and Johnson (1990), Siegler (2003), and Dean, Hubbell, Pitler, and Stone, (2012) all point out the importance of carefully structuring and nurturing effective work in cooperative groups. Boaler (2006) discusses the importance of the teacher's expectations, encouragement, and explicit fostering of critical learning practices during group work sessions. Boaler also brings forth the crucial need to build relational equity among students by addressing issues of status through

mathematics lessons where different insights, methods, and perspectives are valued.

The national organization Teachers of English to Speakers of Other Languages (TESOL) advocates for a broad definition of performance in today's mathematics classroom. TESOL Standard 3 states the necessary condition, "English language learners communicate information, ideas, and concepts necessary for academic success in the area of mathematics" (TESOL, 2006). In Standard 1, TESOL addresses the importance of student interaction and various types of communication, "English language learners communicate for social, intercultural, and instructional purposes within the school setting" (TESOL, 2006). These standards recognize the broad nature of learning, and the importance of verbal and other forms of communication in today's mathematics classroom. Structured partner work and cooperative groups provide settings where students can address these goals as they listen to, speak about, demonstrate, and act out their ideas, while using both English and native conversational and academic language.

Cooperative groups where norms for cooperative learning have been established are a less threatening setting to practice speaking, to ask questions, as well as to hear peers' models of spoken English. Cooperative learning groups increase students' opportunities to be actively involved and to compare mathematical strategies (Cohen, 1994). Both conversational and academic language usage increases. Also, motivation is likely to increase when both group responsibility (positive interdependence) and individual accountability are expected (Nelson, 1996). It is important to group students heterogeneously so that each group represents various levels of English fluency (Chamot & O'Malley, 1994).

Research indicates that when the community and educational institution value primary/native language and give specific supports to aid English acquisition, students' academic success is greater (Tse, 2001). Especially when problem solving is done as a small-group project, and when the topics are culturally relevant, English learners do better in school, both in their native language and target language.

DISCUSSION AND PROJECT QUESTIONS ■

1. How can you be sure that all discourse in your mathematics class meets the needs of all of your English learner students? Give some examples.
2. What are your thoughts about the goals and suggestions in this chapter? What goals and suggestions are most important for your classroom? Describe how you plan to implement specific ideas in your classroom.
3. What behaviors are important for a class to develop in order to maximize language development opportunities during mathematics lessons? Give examples of specific things that you would promote in your classroom.

4. Identify one key concept for a particular grade. How might you use a problem-solving approach and small-group work to promote both the learning of the concept and English language acquisition? Give specific examples and plans.
5. Identify an important mathematics concept and create an accessible problem that will spark small group discussion. You may adapt a textbook or assessment problem so that it has accessible sentences and a context that is relevant and compelling to your targeted group of learners.
6. Discuss two or more Standards of Mathematical Practice in relationship to this chapter's focus: English learners use of conversational language while learning mathematics. You may create examples involving specific mathematical content.