Chapter 5
About Language and Concepts

"How many seas must the white dove sail,
before she sleeps in the sand?"
—Bob Dylan, *Blowin' in the Wind*

Just what is it about math that seems to present such a challenge to so many? While thinking about this chapter, the fifty basic language concepts of the Boehm Test of Basic Concepts (Boehm, 1976) kept coming to mind. As she worked with her students, co-author Mary Ann, a speech and language pathologist, recognized these concepts as "the language of school" or "the language of directions." She realized that many of her students were having difficulty mastering these concepts and applying them in the classroom. Additionally, it became apparent that the classroom-based language interventions she was using were also relevant to developing early math concepts. Not surprisingly, she then discovered that many of the students with language delays were experiencing challenges in both learning to read and developing math skills. The co-morbidity of language and math deficits is now well documented. Children who demonstrate phonologically based reading difficulties also exhibit difficulties in mathematic retrieval and students who display reading comprehension challenges also demonstrate math problem solving difficulties (Light & Defries, 1995).

Further experiences led to the conclusion that students' classroom performance is dependent upon their ability to understand and apply basic language concepts. These concepts appear continuously throughout the school curriculum and are embedded in the language of directions related

to classroom management (sometimes referred to as the hidden curriculum). Consequently, concepts related to the teaching of reading clearly apply to the teaching of mathematics. While the authors recognize the relevance of these concepts to school readiness in general, for the purposes of this book we will address the concepts inherent to the acquisition of math literacy.

Throughout our research of effective mathematics instruction, the notion of mathematics as a language became more evident. It was determined to use the Cardinal Questions as a thinking framework. What do we know about math? What do we do with math? When all is said and done, math is about adding, subtracting, and dividing for the purpose of measurement. We measure quantity, time and space. Adding is about counting things (quantity) as you join them together, subtracting is about counting things (quantity) as you separate them, and dividing is about separating things into equal amounts. Math is about deciphering relationships or comparing and contrasting quantities through the use of numerical symbols and language. Ultimately, math is about measurements and comparison of those measurements using basic language concepts.

Math is a tool that assists us in making sense of how we perceive our world. While reading and spelling are thinking with letters, imagery and language, math is thinking with numbers, imagery and language. Both reading and math are cognitive processes that require dual coding or the assimilation of language and imagery. To become skilled in math fundamentals one must integrate two aspects of imagery: symbol/numeral imagery (parts/details) and concept imagery (whole/gestalt) (Tuley & Bell, 1997). Therefore, it is critical for educators to instruct and assess the language students use to communicate their perceptions of numeric symbol imagery and conceptual imagery.

Educators must think about language and how it evolves as we emerge from our egocentric infant worlds and develop perspectives of our surroundings. Through our five senses we are immersed in making meaning of our surroundings. Inherently, we make comparisons about quantity, space, sound and time. As infants we cry when we are uncomfortable, when we have too little or too much of something. Infants in an English-speaking environment are exposed to words that describe the attributes of our existence, such as wet or dry, hungry or not hungry, thirsty or not thirsty, asleep or awake, light or

dark, loud or quiet, more or less, etc. Comparisons of what is comfortable and uncomfortable in our lives are made and labeled using sight, hearing and touch as referents. While using our five senses we are immersed in learning language. It is important to recognize that the rudiments of math and its associated language are based in the act of comparing and contrasting, thereby using vocabulary to describe these opposite relationships. (See Appendix B, p. 254, for a list of basic language concepts.)

Consider further that the act of comparing is the act that eventually addresses the concept of equal, which is the very underpinning of math equations. The human ability or lack of ability to compare is at the heart of the research of Reuven Feuerstein and forms the basis for his work and research on cognitive modifiability (Feuerstein et al., 2006). It follows that with exposure to, experience with, and instruction in basic language concepts, humans become able to communicate our perceptions of the world. Eventually, we use numbers (mathematics) to refine and define these comparative relationships.

It seems obvious then for educators to wonder about the early language concepts children bring to school. We know we are products of our life experiences (background knowledge) and these are embedded in our personal stories. It therefore stands to reason that educators must first explore students' understanding and use of the basic language concepts that describe their worlds. Conversations with students may provide valuable insight into the language they know and use day to day, as well as the attributes that define their own perceptions.

An effective mathematics curriculum includes explicit language instruction. During instruction of basic language concepts, a discerning teacher will recognize when a student is not demonstrating mastery of essential language skills and will pursue assessment. To assist, we offer the Cardinal Questions as they relate to basic language concepts:

1. **What does the student know** about language that is implicit to describing his/her perceptions of the world?
   - What is the student's first language?
   - What is the student's expressive language ability?
   - What basic language concepts does the student know?

2. **What does the student do** when asked to demonstrate understanding of basic language concepts?
   - Does the student identify word opposites or antonyms?
   - Does the student compare and contrast?
   - Does the student sequence and then describe the pattern?
   - Does the student classify utilizing at least one attribute?
   - Does the student classify utilizing more than one attribute?
   - Does the student describe same and different attributes of his/her perceptions of his/her environment when engaging in discourse?
   - Does the student move his/her body appropriately when following directions that incorporate the basic language concepts?
   - Does the student manipulate objects when following directions that incorporate the basic concepts?

Once you have assessed the student's language skills and are ready to begin preparation for intervention, think about the remaining three Cardinal Questions:

3. **How does the student learn?** (See Chapter Two)

4. **How does the student approach or react to an unfamiliar task?** (See Chapter Two)

5. **What will you do with the knowledge gained from answering the previous four questions?**

Armed with this information, the following five techniques will assist you in teaching language concepts:

1. Movin' and Groovin'
2. Do You See What I See?
3. Sequence Sequester
4. Matchmaker
5. Potent Potentials

"So I go sailing, through the rivers of my mind,
I go sailing, be surprised what you can find,
I go sailing, through the rivers of my mind,
Take a chance on your mind, be surprised what you'll find."
—Stevie Wonder, *I Go Sailing*