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## RESPONSE TO INTERVENTION AND MATHEMATICS

Francis (Skip) Fennell, focusMATH Consultant  
Professor of Education  
McDaniel College  
Westminster, MD

### Understanding Intervention

Intervention and the Response to Intervention (RtI) have become interrelated topics of critical importance for teachers of mathematics. This is particularly true at the elementary school level. No Child Left Behind (NCLB) and the Individuals with Disabilities Education Act (IDEA) both include provisions which require school districts to provide support for students who have difficulty keeping up with day-to-day expectations, hence the need for intervention. RtI can be thought of as an early detection, prevention, and ongoing support system that identifies students and provides them with the support they need before they fall behind. The IDEA Act (2004) encouraged states and school districts to use RtI to provide additional support for students with academic needs, regardless of disability classification.

Intervention provides the opportunity for all students to learn. It is a structured plan for providing instructional materials and activities to support student learning during class time, or in programs before school, after school, or during summer school.

Any response to intervention must assume high quality instruction for all students. RtI programs often engage a teaching-learning cycle. Diagnostic assessments screen for early detection of specific mathematics needs. Instructional actions are then provided to support students in need. The cycle then includes follow-up assessments to determine whether students have made adequate progress and then no longer need intervention, continue to need some intervention, or need more intensive intervention.

### The 3 tiers

The levels of intervention are typically referred to as tiers. RtI is typically thought of as having three tiers, with each tier having specific characteristics (Fuchs, Fuchs, and Vaughn, 2008), although some settings include more than three tiers for the intervention support.

**Tier 1:** Classroom-based intervention assesses or screens all students and particular interventions (e.g., more time on a concept, use of a particular model, more practice, etc.) are determined and typically implemented by the classroom teacher.

**Tier 2:** Targeted assistance in key mathematics concepts is designed for small group settings in the classroom or as supplemental instruction provided by the classroom teacher, a mathematics specialist, or an instructional assistant. This additional time for mathematics will vary, but may range from 20 to 40 minutes four to five times a week (Fuchs, Fuchs, and Craddock, et al, 2008).

**Tier 3:** Supplemental programs that occur outside of the daily mathematics lesson are for students requiring more intensive assistance. Special education services and professionals may be involved at this level. At this level, foundational mathematics topics must be central to the instructional activities delivered.

While intervention and RtI may be considered a by-product of NCLB and IDEA, it has become a “lifeline” for struggling mathematics learners and must be a carefully considered opportunity for students in need, regardless of instructional level or how tiers are defined and addressed within schools and school districts.

## **focusMATH**

Consider the title focusMATH. This intervention based program allows the classroom teacher or the interventionist to focus and assist students in capturing the understanding, proficiency, and problem solving success within particular mathematics topics. Students having access to these materials will be at Tiers 2, 3, or perhaps beyond. Teachers will find that focusMATH provides assessments for screening and determining specific needs among mathematics topics aligned with the Curriculum Focal Points (NCTM, 2006).

The Focal Points—three at each grade level— represent important mathematical topics that are presented as a framework for states and school districts to determine topics of emphasis at particular grade levels.

focusMATH directly aligns with the Curriculum Focal Points (NCTM, 2006) and is intended to address core mathematics topics. focusMATH for Grade 3 consists of three books. Here is an example.

### **Book A:** Number and Operations and Algebra

**Topic 1:** Addition and Subtraction in Book A is identified as a foundational skills topic, which is addressed before students work with on-level skills and concepts in Topic 2: Multiplication Meanings and Facts and Topic 3: Division Meanings and Facts. Multiplication can be thought of as repeated addition or skip counting, therefore a strong understanding of addition is necessary before learning multiplication. Similarly, division can be thought of as repeated subtraction.

### **Book B:** Number and Operations

**Topic 1:** Comparing and Ordering Whole Numbers in Book B begins with important foundational skills. Work with this topic includes using the words and symbols for

greater than, less than, and equal to, comparing and ordering, and estimation. The book then applies students' knowledge of whole numbers to build important conceptual understandings involving fractions, including representing fractions as well comparing and ordering fractions.

**Book c:** Geometry

**Topic 1:** Lines, Line Segments, and Angles includes activities involving foundational skills for identifying two-dimensional shapes. The focus of Topic 2: Shapes is on two-dimensional plane figures such as triangles and quadrilaterals.

## References

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National Council of Teachers of Mathematics (2006). *Curriculum Focal Points for PreKindergarten through Grade Eight: A Quest for Coherence*. (Reston, VA: National Council of Teachers of Mathematics).



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## ENGLISH LANGUAGE LEARNERS AND MATHEMATICS

Jim Cummins, focusMATH Consultant  
Professor University of Toronto  
Toronto, Canada

### The Language of Mathematics

Language is central to the teaching of every school subject. The concepts embedded in the curriculum are inseparable from the language we use to teach these concepts to our students. This fusion of language and content across the curriculum presents both challenges and opportunities in teaching English Language Learners (ELL).

We sometimes think of mathematics as less dependent on language than other areas of the curriculum. However, the language of mathematics has its own characteristics that present significant challenges, as well as learning opportunities, for ELL students. Mathematics and language are inter-connected at several levels.

As in other academic subjects, mathematics uses a specialized technical vocabulary to represent concepts and describe operations. As early as Grade 1, students are required to learn the meaning of words such as addition, subtraction, sum, and addend that are likely to be found only in mathematics discourse. Other terms have specific meanings in mathematics that differ from their meanings in everyday usage and in other subject areas. Examples include words such as table, product, even, and odd. Homophones may also be confusing for ELL students. How would they know the difference between sum and some? Primary grade students are required to learn concepts such as number facts and addition sentences at a time when many of them (and particularly ELL students) may not know the broader meanings of the words facts and sentences.

In addition to the technical vocabulary of mathematics, language intersects with mathematics at the broader level of general vocabulary, syntax, semantics, and discourse. Most mathematical word problems require students to understand propositions and logical relations that are expressed through language. Clearly, the language demands of the math curriculum increase as students progress through the grades and this can cause particular difficulties for ELL students.

## The ELL Challenge

Content teachers are usually acutely aware of the challenges of teaching ELL students within the subject matter classroom. However, they may be less aware of the opportunities that exist for extending students' knowledge of academic English as they learn academic content. For example, students who are learning mathematics are learning that there are predictable patterns in the ways in which we form the abstract nouns that describe mathematical operations. Many of these nouns are formed by adding the suffix-*tion* to the verb, as in add/addition, subtract/subtraction, multiply/multiplication.

Numerous research studies (see Cummins, 2000 for a review) have demonstrated that ELL students generally pick up everyday conversational fluency within a year or two. However, a much longer period (generally at least five years) is required for students to catch up to native speakers in academic language proficiency (e.g., reading and writing skills). In mathematics, ELL students often make good progress in acquiring basic computation skills in the early grades; however, they typically experience greater difficulty in solving word problems particularly as these problems become more complex linguistically in later grades.

Thus, ELL students may require extended language support within the classroom in order to continue to make grade-level progress in content areas like mathematics. Despite the fact that they have acquired conversational fluency in English together with basic mathematical vocabulary and computational skills, students may still experience gaps in their knowledge of more sophisticated vocabulary, syntax, and discourse features of mathematical language.

## Instructional strategies

The research on ELL students' language learning (e.g., Gibbons, 2002) can be summarized in terms of five essential principles that support ELL students in acquiring academic content and simultaneously extending their ability to understand and use language as a tool for cognitive and academic growth.

- 1. Identify and communicate language and content objectives.** In planning and organizing a lesson, teachers must first identify what language and content objectives they will attempt to communicate to students. For example, focusMATH provides definitions, descriptions, examples, and visual supports when vocabulary terms are introduced for the first time as a means of simultaneously teaching both concepts and language. Essential vocabulary is reinforced across multiple lessons.

- 2. Frontload the lesson.** Frontloading refers to the use of pre-reading or pre-instructional strategies that prepare ELL students to understand new academic content. Frontloading strategies used in focusMATH include activating prior knowledge, building background, previewing text, pre-teaching vocabulary, and making connections.

**3. Provide comprehensible input.** Language and content that students can understand is referred to as comprehensible input. Teachers make use of non-linguistic supports to enable students to understand language and content that would otherwise have been beyond their comprehension. focusMATH employs a wide range of visuals and manipulatives to enable students to understand math concepts and language.

**4. Enable language production.** Language production complements comprehensible input and is an essential element in developing expertise in academic language. Within focusMATH, use of both oral and written language enables students to solve problems, generate insights, and obtain feedback from teachers and peers.

**5. Assess for content and language understanding.** The instructional cycle flows into assessing what students have learned and then spiraling upward into further development of students' content knowledge and language expertise. Within focusMATH, formal assessments include a Program Placement Test, Topic Tests, and a Program Exit Test. Also, opportunities for daily progress monitoring are given at point-of-use within each Step.

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