

Clinical Forum

Evidence-Based Practice, Response to Intervention, and the Prevention of Reading Difficulties

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his article provides an evidence-based perspective on response to intervention (RTI) as a means to organize reading interventions for at-risk pupils in the emergent and early literacy stages of reading development. These reading stages coincide with the period of time in which intervention is most effective for equalizing disparities among lower achieving and higher achieving children in their reading development (Fuchs et al., 2002; Speece, Case, & Molloy, 2003; Vaughn, Linan-Thompson, & Hickman, 2003; Vellutino et al., 1996). Reading interventions delivered during this period are considered preventive, aimed at lowering a child's risk for developing later reading difficulty by building skills that are causally associated with skilled reading success. My goal in this article is to provide speech-language pathologists (SLPs) with an up-to-date discussion of how schools (and the professionals

within them) might align their practices with current research and policies targeting a reduction of reading difficulties.

EDUCATIONAL RESEARCH, PRACTICE, AND POLICY: INFLUENCES ON EVIDENCE-BASED PRACTICE (EBP) IN READING INTERVENTIONS

The movement toward becoming an evidence-based discipline is having tremendous influence on the ways in which SLPs deliver their interventions within the public schools. The current educational-policy climate emphasizes the need to bring "evidence-based progress" to educational practices generally and reading

ABSTRACT: Purpose: This article provides an evidence-based perspective on what school communities can do to lower the prevalence of reading difficulties among their pupils through preventive interventions. It also delineates the roles that speech-language pathologists (SLPs) might play in these interventions. **Method:** This article is organized to first provide a broad overview of current directions in research, practice, and policy in educational interventions, with an emphasis on how the three are increasingly integrated to respond to evidence showing that American school children are underperforming in reading. Next, the concept of response to intervention (RTI) is described. RTI is an educational policy and practice that is grounded in the accumulated literature that focuses on how schools might better organize themselves to

deliver multitiered reading interventions to reduce children's risk for reading disability. Last, this article provides three organizational principles that school-based professionals, including SLPs, might follow to deliver RTI interventions.

Implications: This article provides an important and timely description of key concepts in the prevention of reading difficulties through proactive multitiered interventions. SLPs can draw on the suggestions presented here to inform their local efforts in implementing preventive literacy programs that are consistent with an RTI paradigm.

KEY WORDS: emergent literacy, early literacy, reading disability, response to intervention, educational services

instruction specifically (Stanovich & Stanovich, 2003). As with other professionals, the services of school-based SLPs are being increasingly scrutinized to ensure that they have concrete and measurable impacts on high-priority dimensions of pupil learning.

A driving force in the current political climate is, undoubtedly, the No Child Left Behind 2001 federal legislation, which mandates that school-based professionals adopt scientifically based research (SBR) to equalize reading disparities among students. As members of the special education workforce, SLPs are not immune from political pressures calling for improvements in student achievements and data-based outcomes relevant to reading achievement. As SLPs are aware, the accumulated scientific literature shows that (a) reading difficulties are prevalent among school-age children with language impairment (e.g., Catts, Fey, Tomblin, & Zhang, 2002; see Schuele, 2004 for review), (b) early language weaknesses are one of the foremost signs of later reading disability (e.g., Gallagher, Frith, & Snowling, 2000), and (c) traditional speech-language interventions have little direct impact on reading-related skills (e.g., Gillon & Dodd, 1995). Like other professionals serving at-risk pupils in schools, SLPs are expected to consult the available scientific evidence to ensure that their interventions are as effective as they can be and to ensure that their interventions impact reading achievement.

Applying the tenets of EBP to clinical decision making within the public schools will help to ensure that SLP practices are aligned not only with educational policy at the program, building, district, state, and federal levels, but also with the accumulated scientific literature on reducing the prevalence of reading difficulties. Indeed, the pressure for improved alignment of policy, research, and practice, particularly as they apply to reading interventions within the public schools, seems warranted. Current prevalence data show that more than one third of our nation's fourth graders do not exhibit basic reading proficiency (National Assessment of Education Progress [NAEP], 2003). Among students failing to achieve basic-level reading skills, there is a strikingly disproportionate representation of African American (60% below basic), Hispanic (56% below basic), and low-income students (55% below basic). Statistics also show that 80% of second graders with non-specific language impairment and 62% with specific language impairment (SLI) place in the bottom quartile (< 25%) on measures of reading comprehension (Catts, 2005; Catts et al., 2002). The number of children who fail at reading in our nation's schools far exceeds that which can be attributed to "natural" causes or even normal variability (e.g., Shaywitz, Escobar, Shaywitz, Fletcher, & Makuch, 1992). Rather, many children who perform poorly in reading achievement do so because schools fail to provide adequate instruction to at-risk children who exhibit significant risk factors that make learning to read very difficult (e.g., exhibiting language impairment, living in poverty, learning English as a second language; Vellutino, Scanlon, Small, & Fanuele, 2003).

Current educational policies (e.g., No Child Left Behind) emphasize the need for schools to re-organize themselves to (a) implement preventive interventions for children showing early vulnerabilities for reading failure and (b) apply more valid approaches to identify reading disability that ensure that all children have had ample opportunities to achieve skilled reading. Few school-based SLPs remain unaware of the heightened attention to their roles and responsibilities concerning the prevention of reading disabilities and the simultaneous press for evidence-based solutions to reducing disparities among children in their reading achievement. Nonetheless,

many likely have a variety of questions concerning how they might situate themselves as professionals who are concerned with reading achievement within their larger school community. Although SLPs can certainly embed reading-related targets in their extant interventions, they can also play a substantial and potentially more powerful role by collaborating with other school professionals to heighten the quality of general education (particularly as it relates to reading instruction) and to deliver reading-related supplemental interventions for pupils who require more targeted interventions. In this way, SLPs play an important role in preventing reading difficulties not only for those children on their caseloads, but for all children who show sustained difficulties in reading development.

In the remainder of this article, I discuss the expanding literature showing that sustained and intensive preventive interventions during preschool, kindergarten, first grade, and second grade are effective for reducing reading difficulties among at-risk pupils. I also show how estimating children's RTI provides a valid index for identifying children with reading disability (RD) (e.g., McMaster, Fuchs, Fuchs, & Compton, 2005; Vaughn et al., 2003; Vellutino et al., 2003). For SLPs, implementation of interventions following an RTI model may attenuate the risk for a future RD for many of their pupils.

RESPONSE TO INTERVENTION: AN EVIDENCE-BASED PRACTICE

RTI is an evidence-based initiative that seeks to redefine how reading disabilities are identified and addressed within the public school system. RTI is a prevention model that features multiple tiers of reading interventions that are layered on pupils based on their individual needs. It is considered a preventive model because these multiple tiers of support are introduced to students in the earliest stages of reading development (in prekindergarten [preK] and kindergarten, ideally), and children's progress within intervention is carefully and regularly scrutinized to ensure progress in achieving criterion benchmarks in reading. RTI features a "continuum of increasingly intensive, specialized instruction" that is implemented in the earliest stages of reading development and continued until the end of second or third grade (National Research Center on Learning Disabilities, 2003, p. 3). It is at once an educational policy (endorsed in the current amendments of the Individuals with Disabilities Education Improvement Act of 2004; U.S. Department of Education, 2005) and an educational practice that is grounded in the accumulated empirical research literature. In short, RTI models integrate research, practice, and policy.

RTI is grounded in scientific evidence suggesting that current approaches to the identification of reading disabilities (a) are insufficiently sensitive and specific, leading to high rates of false positives and false negatives; (b) lack an empirical basis (such as the use of discrepancy approaches); and (c) fail to promote proactive early interventions that might mitigate children's early reading difficulties (Vellutino et al., 1996, 2003). It is important to recognize that the term "reading disability" presumes that a child who is failing to achieve skilled reading has received ample opportunity to do so, thus indicating presence of a neurologically based learning disability (National Joint Committee on Learning Disabilities, 1991). Critics of current approaches to RD identification argue that many children are misdiagnosed as having RD when, in fact, they would have developed skilled reading if they had had the opportunity to do so.

RTI provides a theoretical and practical alternative for identifying children who have RD and for differentiating between children with experientially based and cognitively based reading difficulties. The three key premises are to (a) improve the sensitivity and specificity of the approaches that are used to identify children with RD, (b) eliminate the use of intelligence (IQ) testing and IQ-achievement discrepancy as a means for identifying RD, and (c) promote the use of preventive and early interventions that attenuate children's risk for RD (Fuchs, Mock, Morgan, & Young, 2003). RTI models typically use a three-tiered approach in their design (Fletcher, Coulter, Reschly, & Vaughn, 2004; Fuchs et al., 2003; Vaughn et al., 2003):

- All children receive exemplary reading instruction from preschool forward that is grounded in the current best evidence on how children learn to read. This instruction features protected time for classroom-based reading instruction (e.g., 90-min daily in elementary reading programs) and systematically and explicitly targets those skills that are causally linked to achievement in both word recognition and reading comprehension (e.g., vocabulary, phonological awareness). This is called the "first tier" of instruction, and for the majority of children, it refers to general classroom instruction.
- Children's achievements within the first tier of instruction are carefully monitored using scientifically validated progress monitoring tools that can specify risk in reading growth. For children whose growth trajectory lags, supplemental tiers of intervention are introduced to provide additional support in developing critical early reading skills. Optimally, these supplemental interventions are provided to at-risk pupils during preK, kindergarten, and first, second, and third grade. Supplemental interventions are considered the "second tier" of intervention in RTI.
- The progress of children receiving supplemental interventions (in preK through third grade) is monitored periodically both to guide the targets and techniques of the supplemental intervention and to identify when a child's reading achievement is sufficient to remove the supplemental intervention.

When supplemental interventions are removed for a given child, his or her reading achievement within the first tier is carefully monitored to ensure that he or she continues to thrive.

- Children who fail to achieve criterion levels of reading performance by third grade (or beyond) receive an in-depth assessment to identify whether RD is or is not present. This assessment does not use IQ testing, but rather emphasizes the identification of processing limitations that may be impacting the child's progress in attaining skilled reading. If RD is indicated, the child receives special education services to provide ongoing remediation of reading difficulties and any associated processing difficulties; special education placement is considered the "third tier" of support in RTI.

The RTI model has significant implications for the SLP who is invested in promoting reading achievement among the pupils on his or her caseload and in adhering to the current best evidence on approaches to reducing reading difficulties. Implementation of RTI models requires an explicit focus on improving the quality of literacy instruction in the general education environment and delivering systematic supplemental tiers of literacy instruction to struggling learners from preK forward. SLPs can take on important responsibilities in both types of activities. For instance, as discussed later in this article, SLPs can conduct a systematic audit of the general education environment to study language and literacy instruction (see Table 1 for examples of tools for this audit) and provide consolation on improving instructional quality. Given that RTI privileges early identification and intervention for pupils struggling with reading before receipt of a formal special education placement (or even consideration of such a placement), professionals who traditionally have served only children in *postreferral* interventions are having their roles altered to avail them to increased participation in *prereferral* activities delivered to a general population of at-risk pupils. Prereferral interventions may ultimately reduce the number of children who then go on to require formal special education services, which are decidedly more costly and less effective at remediating reading problems (Fuchs, 2003).

Table 1. Examples of tools for an audit of the adequacy of first-tier instruction.

<i>Name of instrument</i>	<i>Grade levels</i>	<i>Focus</i>
Arnett Scale of Caregiver Behavior (Arnett, 1989)	Preschool	Quality of teacher behaviors related to relationships with pupils, punitiveness, and permissiveness
Classroom Assessment Scoring System (Pianta, La Paro, & Hamre, 2004)	Preschool and early elementary grades	Instructional quality, classroom management, and socioemotional support
Classroom Literacy Environmental Profile ^a (Wolfersberger, Reutzell, Sudweeks, & Fawson, 2004)	Preschool and early elementary grades	Quantity and use of literacy tools, organization of classroom for literacy instruction, quality of literacy instruction, student engagement in literacy activities
Early Childhood Environmental Rating Scale (Harms, Clifford, & Cryer, 2005)	Preschool	Overall classroom organization, including global assessment of children's language-reasoning experiences
Early Literacy and Language Classroom Observation ^a (Smith & Dickinson, 2002)	Preschool	Overall classroom organization, literacy environment checklist, teacher interview
Teacher Interaction and Language Rating Scale ^a (Girolametto, Weitzman, & Greenberg, 2000)	Preschool	Teacher use of 11 oral language facilitation strategies
TEX-IN3 ^a (Hoffman, Sailors, Duffy, & Beretvas, 2004)	Elementary grades	Quantity and quality of texts in class, student engagement during instruction, student interviews

^aInstruments that focus solely on language and/or literacy environment.

In the next sections, I present three principles of practice that are drawn from the current external evidence on RTI implementation. These principles emphasize the roles and tools that SLPs may use in RTI models.

Principle 1: Attention Should Be Directed First Toward Ensuring the Adequacy of Children's Primary Reading Instruction Environments

As the scientific community works to establish why so many children in our nation fail to achieve skilled reading, it increasingly cites the importance of establishing the adequacy of reading instruction that occurs in the general education environment, to start as early as preschool and to continue to third grade (Vellutino et al., 2003). The RTI perspective emphasizes that the first-tier classroom environment is where most children can and should develop their reading abilities and where deficits in reading achievement can be remedied most effectively (e.g., Vellutino et al., 1996, 2003). A key premise in RTI therefore is the need to ensure that the first tier of reading instruction is adequate, if not exemplary. When systematic improvements are made to the first tier of instruction in preschool, kindergarten, or the elementary grades, a substantial number of children should "respond" to this first tier of support, mitigating their risk for later reading difficulty (e.g., Vaughn et al., 2003; Vellutino et al., 2003).

SLPs can serve as important consultants and collaborators in elevating the quality of first-tier reading interventions within the general classroom environment. Previous studies have shown improved outcomes in children's language when SLPs and classroom teachers collaboratively plan and co-teach language lessons in preschool and elementary classrooms (Throneburg, Calvert, Sturm, Paramboulas, & Paul, 2000; Wilcox, Kouri, & Caswell, 1991). A number of key elements (see Appendix) need to be put in place to ensure an adequate first-tier literacy learning environment, and there is much the SLP can do as a consultative and collaborative partner with classroom teachers to guide this process. At its core, the first-tier learning environment must provide protected time for literacy instruction. Although in preschool and kindergarten classrooms, literacy instruction may be emphasized throughout the day in a variety of embedded and incidental ways (see Justice & Kaderavek, 2004; Kaderavek & Justice, 2004), a protected time for large- and small-group literacy instruction is also needed to ensure systematic attention to high-priority reading targets. For preschoolers, this protected time may be a daily 15- or 20-min block of time; in kindergarten, it increases to 30 to 45 min daily; and by first grade, experts recommend 90 min of protected time for large- and small-group literacy instruction (Kame'enui, Simmons, & Coyne, 2000).

Within this protected period of time, teachers should provide direct instruction to address high-priority targets in emergent and early literacy development, which are those literacy skills that are *causally related* to later reading achievements in both word recognition and reading comprehension. Walpole, Justice, and Invernizzi (2004) provided estimates on the amount of time that ought to be spent on various activities directed to different high-priority targets, drawing an analogy between reading instruction and sound nutrition. For example, a model "literacy diet" for first graders includes a 90-min block in which 20% of the time is focused on word study (e.g., phonemic awareness, sight-word development,

phonics instruction), 60% is spent on reading (e.g., independent reading of self-selected texts, guided reading of instructional-level texts, interactive reading with comprehension instruction), and 20% is spent on writing and grammar (e.g., journal writing, dictated writing).

A number of observational studies have found that general education environments can improve their delivery of reading instruction, and that classrooms vary widely in the implementation of best practices (Dickinson & Sprague, 2002; Graue, Clements, Reynolds, & Niles, 2004; McGill-Franzen, Lanford, & Adams, 2002). Observations of preschool classrooms show considerable variability in the number of books available within the classroom, the use of books during large- and small-group instruction, and the extent to which reading targets are included within the classroom curriculum (e.g., Dickinson & Sprague, 2002; Graue et al., 2004; McGill-Franzen et al., 2002; Smith & Dickinson, 1994). Some studies have shown that relatively few preschool classrooms feature daily large-group reading sessions or opportunities for children to practice writing and reading with the support of an adult (Dickinson & Sprague, 2002). As many as one third of Head Start classrooms do not include any formal instruction in reading or its prerequisites (Graue et al., 2004). There is also substantial variability in the amount of time that is spent on reading instruction in elementary classrooms and the percentage of instructional time that is allocated to various reading targets (Foorman, Goldenberg, Carlson, Saunders, & Pollard-Durodola, 2004; Vaughn & Linan-Thompson, 2003).

The variability in the quality of first-tier reading instruction relates to both the *structure* and the *process* of reading instruction. Structural variables are physical or tangible aspects of the classroom and the instruction provided. Those that relate most closely to reading instruction include the physical organization of the classroom (e.g., presence of a classroom library, print on the walls), the use of a core curriculum (e.g., targets and types of activities for reading development), and the daily schedule (e.g., time allocated for large-group, small-group, and one-on-one instruction). Process variables pertain to *how* instruction occurs and reflect a teacher's pedagogical orientation, years of teaching experience, and formal educational training (e.g., Cunningham, Perry, Stanovich, & Stanovich, 2004; Nye, Konstantopoulos, & Hedges, 2004). Process variables that impact the most on the quality of first-tier reading instruction are (a) teachers' responsiveness to individual children's needs, (b) teachers' delivery of high-quality feedback during instruction to guide the learning process, and (c) teachers' use of a variety of learning formats (La Paro, Pianta, & Stuhlman, 2004).

Improving the quality of first-tier reading instruction, to include both structural and process variables, can mitigate early delays in reading development that occur due not only to environmental disadvantage (e.g., limited experiences with books in the home), but also to developmental disability (Fuchs et al., 2002; Gillon, 2000). Thus, SLPs who are concerned with making the largest difference in the reading potential of their students should focus their attention on ensuring the quality of the first-tier learning environment in which their pupils are learning to read. This requires not only that SLPs collaborate closely with classroom teachers, but also that they use objective tools for qualifying and quantifying the classroom learning environment, particularly its supports for reading instruction.

Approaches to evaluating the quality of the first tier. The extent to which high-quality structural and process variables are in place

can vary tremendously between classrooms. Some preschool and kindergarten classrooms may not use a core curriculum that specifies reading targets and instructional approaches; likewise, some first- and second-grade classrooms may use a core curriculum but provide whole-group instruction (rather than differentiated instruction) that fails to meet the individual needs of pupils. Some preschool and kindergarten classrooms may have few indices of print around the room and may not have a classroom library or writing center available for student use. Some first- and second-grade classrooms may contain well-stocked classroom libraries, but few books that are appropriate for children who are not yet readers. Some teachers may have inadequate skills in teaching specific reading-related skills, such as phonemic awareness (Cunningham et al., 2004), and therefore provide inadequate or incorrect feedback to students during such instruction. A systematic audit of the first-tier learning environment is an important first step in improving reading instruction and reducing reading difficulties within a school (Kame'enui et al., 2000). This audit involves careful analysis of teachers' instructional priorities and practices, classroom curriculum and learning materials, time allocated to reading instruction, and the literacy richness and tangible learning supports within the classroom.

Several scientifically based tools are available to guide this audit and ensure its objectivity and value. Table 1 provides some such instruments. The SLP may use any one or a combination of these instruments. The results of the evaluation should be used to set specific goals to enhance the processes and structures related to reading instruction in the classroom. To provide an example of what audit results might look like, the data in Figure 1 report results that were obtained from my administration of the Early Literacy and Language Classroom Observation (ELLCO; Smith & Dickinson, 2002) in a rural Head Start classroom in West Virginia. This observation was conducted as part of the local school district's Early Reading First (ERF) grant, which used a team-based approach to improve the quality of first-tier emergent reading instruction. Administration of the norm-referenced Test of Early Reading Ability—2 (Reid, Hresko, & Hammill, 1991) to the children in

this classroom, in which 62.5% of the children received reading quotient scores below 85 (more than 1 *SD* below the mean) indicated the need for focused attention on the quality of literacy instruction in the classroom.

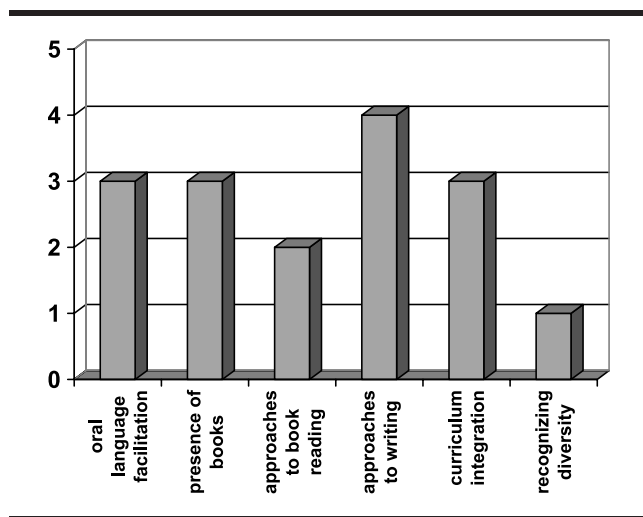
As the data in Figure 1 show, the classroom performed relatively well on approaches to writing instruction but had average scores on oral language facilitation, presence of books, approaches to book reading, curriculum integration, and attention to diversity. A team (consisting of an SLP, literacy coach, classroom teacher, and classroom assistant) reviewed these results and set four goals for classroom enhancements: (1) improve the quality of the teacher's individual and small-group conversations with children; (2) increase the variety of books available in the classroom library and other centers, including books that feature diversity; (3) improve the teacher's use of evidence-based strategies when reading books with children; and (4) integrate attention to literacy throughout the entire classroom curriculum. Professional development provided during the remainder of the year supported the teacher and her team so that they could achieve these goals.

Optimally, with careful attention to improving the quality of the first-tier learning environment, the risk for reading difficulty for children who are underperforming in literacy will decrease, and the need for subsequent special education services for RD may also be reduced.

Principle 2: Children's Literacy Achievements in the First-Tier Instructional Environment Should Be Monitored Carefully to Identify When and If Additional Tiers of Support Are Needed

RTI requires that systematic assessment be conducted to monitor children's emergent and early reading development within the first tier of instruction so that additional supplementary supports can be delivered to those pupils who fail to respond adequately to the first-tier learning environment. Two primary types of assessment are used in RTI models: benchmark measures and progress monitoring measures. *Benchmark measures* are used to evaluate classroom performance in reading as a whole, to set instructional goals for the entire class, and to organize students into small flexible groups for differentiated instruction. Typically, benchmark measures include both criterion-referenced and norm-referenced procedures to characterize how well children are progressing on specific high-priority reading targets (e.g., phonological awareness, word recognition) and to compare their performance against normative references. Benchmark measures may comprise a single comprehensive assessment that examines an array of reading skills (e.g., phonological awareness, alphabet knowledge, sight word knowledge, etc.), or several measures may be combined when a single test is deemed inadequately comprehensive. An example of a relatively comprehensive benchmark assessment is the Phonological Awareness and Literacy Screening (PALS), which is available in PreK (Invernizzi, Meier, & Sullivan, 2002), and Grades K to 3 versions (Invernizzi, Meier, Swank, & Juel, 2004). Benchmark tools like the PALS are typically administered in the fall and the spring of the academic year, although performance at an intermediate point (e.g., winter) may also be collected. Benchmark measures not only provide a tool for teachers to use at the start of the year to guide instruction for the class, but are also used as pretest–posttest measures to summatively evaluate reading instruction in a classroom or program.

Figure 1. Results from the Language, Literacy, and Curriculum Checklist of the Early Literacy and Language Classroom Observation (Smith & Dickinson, 2002) for one Head Start classroom; maximum score for item = 5 points.



Progress monitoring measures, also called curriculum-based measures, typically supplement the use of benchmark measures. Progress monitoring measures are used to formatively evaluate individual children's performance on specific indicators of progress within the classroom curriculum (Compton, 2000). These tools may involve both criterion-level and normative-type tasks, but they differ from benchmark measures in that they are given relatively frequently, possibly as often as every 2 to 3 weeks (Kame'enui et al., 2000). The Dynamic Indicators of Basic Early Literacy Skills (DIBELS; Kaminski & Good, 1998) is likely the most rigorously studied progress monitoring tool available for kindergarten through sixth grade (e.g., Baker & Smith, 2001; Buck & Torgesen, 2003; Good & Kaminski, 1996). Each subtest examines children's performance on a specific literacy task within a 1-min period, such as the number of nonsense words that are read correctly (Nonsense Word Fluency) and the number of letters that are named correctly (Letter Naming Fluency). For preschool-aged children, the downward extension of DIBELS is *Get It, Got It, Go!*, which was developed at the University of Minnesota (see Missall & McConnell, 2004). Designed for frequent use, progress monitoring tools are used specifically to track children's performance within the curriculum and to identify those children who lag in literacy growth even within the context of first-tier and supplementary interventions.

An important difference between benchmark and progress monitoring measures is the *instructional transparency* of children's outcome scores. Untimed benchmark measures typically provide a detailed profile of children's performance levels on a specific set of tasks corresponding to critical aspects of reading development (e.g., knows 12 letters of the alphabet, recognizes rhyme patterns 40% of the time). Benchmark measures tell us what children know at a given point of time, and the results are transparent for identifying future goals in reading instruction (e.g., increase number of letters known, improve rhyme awareness). A variety of programs and materials are available to address these general instructional goals.

In contrast, timed progress monitoring measures are designed to provide quick checks of performance to monitor children's growth over time (e.g., number of letter-sounds named in a minute). Because of this design feature, it may be difficult to translate children's outcomes directly into tangible goals for instruction. For instance, suppose a child names only five letters correctly in 1 min on a progress monitoring task; a direct translation of this result to instruction would be to provide intervention that increases the number of letters the child can name correctly in 1 min. This is not a very functional or meaningful goal, however, as it is not clear that directly improving the rate of letter naming in a 1-min period will transfer to improved reading outcomes in the short or long term. Rather, the primary purpose of progress monitoring measures is to identify children whose rate of progress in instruction is insufficient relative to normative growth rates (Compton, 2000). Children whose growth trajectory is inadequately steep, suggesting insufficient progress in a specific skill area, may be identified for a second tier of supplemental support that complements the first tier of classroom instruction (Compton, 2000; Fuchs, 2003). Thus, progress monitoring measures are often used for the purpose of "problem identification" to track children's trajectory within first-tier reading instruction and during any supplemental tiers (Kaminski & Good, 1998).

The use of both benchmark and progress monitoring tools is essential in RTI frameworks, and the complementary use of both types of tools is likely familiar to the SLP. When children begin language intervention, the SLP typically conducts a comprehensive

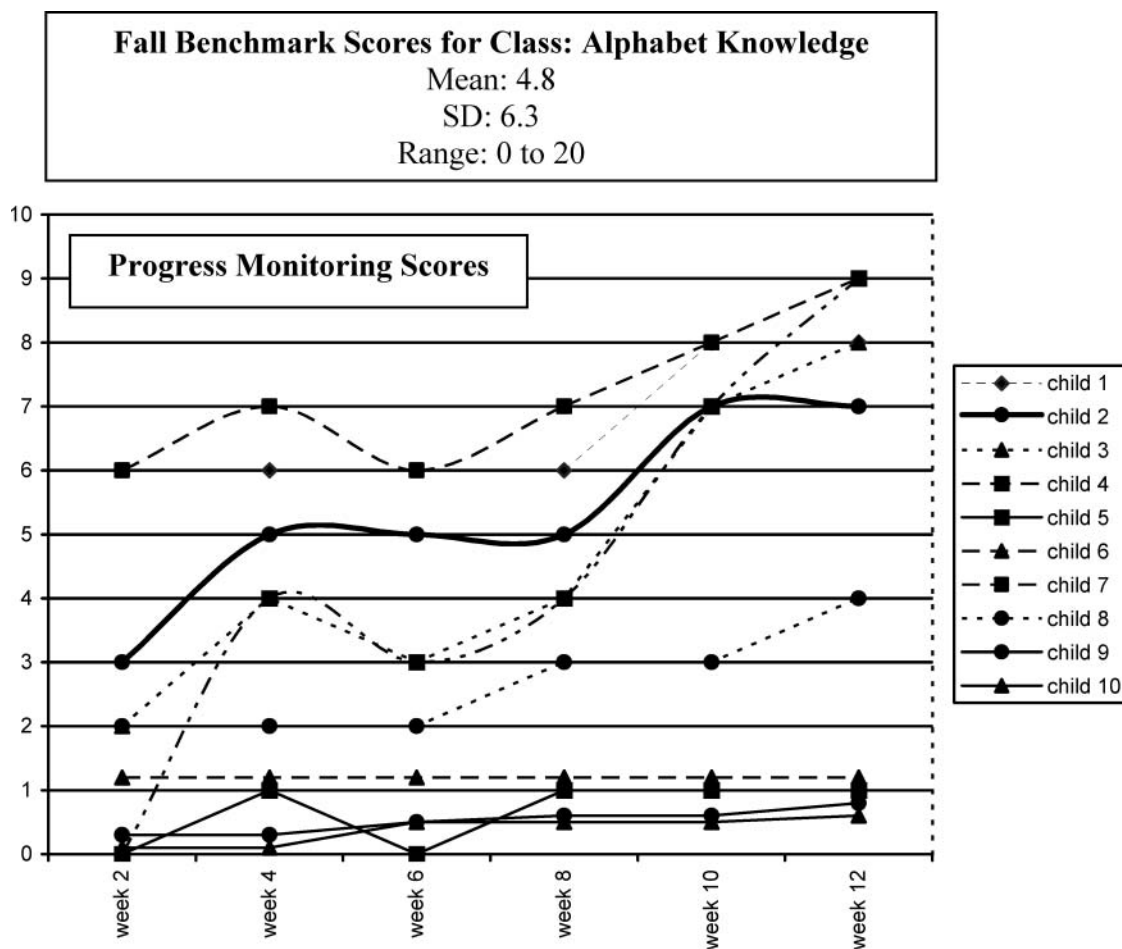
evaluation of key aspects of language in order to profile areas of strength and need. This is akin to administering a benchmark measure. During intervention sessions, the SLP typically collects brief probes in targeted areas to document progress. These are akin to administering progress monitoring measures. To illustrate use of these two types of tools in the area of reading, Figure 2 provides hypothetical benchmark data and progress monitoring outcomes for ten 5-year-olds during the first 12 weeks of kindergarten. For the fall benchmark assessment, the total number of upper case alphabet letters identified by each child in an untimed test was identified and averaged for the pupils as a whole. The number of letters that were named correctly in a 1-min test administration is graphed to show changes in performance over a 12-week period during which children experienced a high-quality, first-tier literacy learning environment. As the data in this graph show, 4 children (Child 2, 5, 6, and 10) are not progressing in their alphabet knowledge at the same rate as their peers, suggesting that they are not responding adequately to first-tier instruction. For these children, an extra tier of supplemental support is warranted to accelerate their alphabet knowledge.

Principle 3: Additional Tiers of Support Should Duplicate and Extend the Instruction of the First-Tier Environment, and Children's Performance in These Tiers Should Be Monitored Carefully

In nearly every classroom providing a high-quality first tier of instruction, at least some children will fail to keep pace with their peers to achieve adequate performance on criterion-level reading benchmarks. In some classrooms serving a large number of high-risk pupils, as many as half of the pupils will fail to exhibit adequate progress toward achieving benchmarks within the first tier of instruction (Justice & Dunaway, 2005). For these youngsters, RTI models advocate inclusion of a second tier of instruction to *supplement* the instruction that is occurring in the first tier. This second tier is designed to provide an extra dose of emergent or early reading instruction to struggling learners. This extra dose typically features a lower adult-to-student ratio (e.g., 1:5), more homogenous grouping of pupils, and consequently, greater opportunity for targeted instruction and instructional scaffolding. Often, this second tier uses a standard protocol that includes a set series of activities to target a full range of high-priority literacy targets (see Vaughn et al., 2003, for an example). In RTI models, children are identified for participation in second-tier intervention using a variety of approaches, including measuring their slope of growth on progress monitoring measures (see Fuchs, 2003).

For preschoolers and kindergartners, the second tier typically consists of two or three small-group sessions weekly, with each lasting approximately 30 min, providing an additional 60 to 90 min of instruction per week. For first and second graders, the second tier increases to 30- to 45-min daily sessions of small-group or one-on-one instruction (for an additional 150- to 225-min instruction weekly) (see Table 2). A variety of school professionals may be called on to deliver this second tier, including the SLP in some districts. Given the prevalence of reading difficulties among children with language impairment (Catts et al., 2002), this tier is likely to include a large proportion of those pupils who are currently receiving speech-language services (Schuele, Justice, Knighton, Kingery, & Lee, 2005).

Figure 2. Benchmark and progress monitoring outcomes (hypothetical data) for 10 kindergartners on a measure of letter identification.



An important goal of the supplemental second tier is to *accelerate* the reading (or prereading) development of children who display inadequate progress in emergent or early reading development during first-tier instruction. Without access to a second tier of intervention, children who show inadequate growth may maintain their established pace of emergent or early reading development. It is unlikely, however, that their pace of growth will exceed that of their better achieving peers, so they may never catch up. As a number of studies have shown, children's pace of reading growth is relatively stable from kindergarten onward, with skills at the beginning of the year the best predictor of skills at the end of the year, even with high-quality first-tier instruction (e.g., Walpole, Chow, & Justice, 2004). As research in previous decades has shown, in the absence of high-quality preventive interventions, poor readers tend to stay poor readers (Juel, 1988). RTI models are designed to change this poor outcome by accelerating the pace of reading development so struggling readers can achieve grade-level reading competencies by the end of the academic year.

Research studying the effectiveness of Tier II approaches suggests that second-tier intervention does not require the use of special resources or strategies. Rather, second-tier interventions often replicate the learning goals and materials that were used in

the first-tier environment, provide these with greater intensity, and feature smaller and more homogenous groupings of students than is possible in the first tier (Speece et al., 2003; Vellutino et al., 2003). There are, however, differences in the second-tier instructional goals for pupils in the emergent literacy period of reading development (preschool) and the early reading period (kindergarten to second grade). In the next sections, I briefly summarize high-priority targets and general approaches for organizing the second tier of intervention for emergent literacy and early reading second-tier instruction.

High-priority targets: Emergent literacy. Children in the emergent literacy stage of reading development are acquiring myriad competencies and interests related to reading; however, few are *causally* related to their later reading development. For instance, there is no evidence of which I am aware that reading signs in the environment and scribbling with a crayon are causally linked to later reading. Many children learn to read without having ever read environmental print or played with crayons in pretend writing (e.g., Masonheimer, Drum, & Ehri, 1984). Whereas these represent important acts that orient children to the intentions of reading, they are not necessary precursors to reading, although their achievement may be targeted in the first-tier learning environment (Justice

Table 2. Descriptive characteristics of second-tier supplemental interventions by grade level.

<i>Grade level</i>	<i>Frequency</i>	<i>Adult: Pupil ratio</i>	<i>Activity sequence</i>	<i>Reference</i>
PreK	2× weekly for 30 min	1:5 or 1:6	1. Sign in/name writing (print knowledge activity) 2. Alphabet knowledge activity 3. Shared storybook reading with discussion of target words (vocabulary) 4. Phonological awareness activity 5. Journal writing	Justice, Chow, Capellini, Flanigan, & Colton (2003)
Kindergarten	2× weekly for 30 min	1:2 or 1:3	1. Print concepts and print awareness activity 2. Alphabet knowledge activity 3. Phonological awareness activity 4. Letter–sound mapping activity 5. Sight word activity 6. Guided reading	Vellutino, Scanlon, Small, & Fanuele (2003)
First grade	3× weekly for 35 min	1:2	1. Letter–sound recognition activity 2. Decoding activity 3. Sight word activity 4. Short story reading activity 5. Partner reading	McMaster, Fuchs, Fuchs, & Compton (2005)
Second grade	5× weekly for 35 min	1:3	1. Reading fluency activity (e.g., repeated reading activity) 2. Phonemic awareness activity 3. Reading comprehension activity using decodable books with pre-, during, and postreading activities 4. Word study/phonics 5. Writing	Vaughn, Linan-Thompson, & Hickman (2003)

& Kaderavek, 2004). In contrast, to eventually transition to beginning reading, four high-priority targets that are consistently and strongly associated with later reading outcomes are emphasized for 4-year-old children during the second tier of instruction: alphabet knowledge, print knowledge, phonological awareness, and vocabulary. Meta-analyses examining the strength of association among numerous precursory skills to later reading achievements in word recognition and reading comprehension show these variables to be the most consistent and robust predictors (Hammill, 2004; Lonigan, 2004).

Alphabet knowledge. Alphabet knowledge (also called letter knowledge) is, simply put, the child's knowledge of the different alphabet letters. There is currently no evidence suggesting the exact number of letters that a child should learn during the emergent literacy period, but it is clear that children with knowledge of more rather than fewer letters are poised to be successful in their transition to decoding (Muter, Hulme, Snowling, & Stevenson, 2004; Schatschneider, Fletcher, Francis, Carlson, & Foonman, 2004; Storch & Whitehurst, 2002; Vellutino et al., 1996). There also appears to be no evidence privileging the learning of uppercase letters before lowercase letters, or vice versa, although most studies on the relationship of early alphabet knowledge to later decoding typically have tested children on only the uppercase letter, showing performance on such measures to be strongly linked to later reading outcomes, particularly in decoding (see Storch & Whitehurst, 2002).

Print knowledge. Print knowledge is the child's knowledge of the rule-governed orthography of the written language. As children progress in their print knowledge, they learn the terminology of various print units (e.g., letter, word, sentence, exclamation point), and they recognize that print organization varies across different

genres (e.g., signs vs. menu vs. narrative text; see Justice & Ezell, 2001). Some experts contend that print knowledge, particularly the child's understanding of the rule-governed organization of print units (particularly the written word), provides a bootstrap to other aspects of reading development, including phonological awareness and letter-sound correspondence (Morris, Bloodgood, Lomax, & Perney, 2003).

Phonological awareness. Phonological awareness is the child's sensitivity to the various phonological units that make up spoken speech, including words, syllables, onsets, rimes, and phonemes. Development of phonological awareness tends to follow a developmental continuum, with awareness of word-level units (words, syllables) preceding awareness of subsyllabic units (onsets, rimes) and phonemic units (phonemes) (Anthony, Lonigan, Driscoll, Phillips, & Burgess, 2003; Carroll, Snowling, Hulme, & Stevenson, 2003). However, children need not achieve mastery in their awareness of larger units (e.g., words) before displaying awareness of small units (e.g., phonemes). There is overlap in children's developing awareness of different discrete units, leading researchers to characterize phonological awareness growth as a "quasi-parallel" hierarchical progression rather than a strict hierarchical or developmental progression (Anthony et al., 2003). There is little evidence indicating what level of phonological awareness a child must achieve to be a good reader, or on what type of task(s) he or she should be able to perform adequately if not masterfully. What is clear, however, is that children *must* exhibit a threshold of phonological awareness in order to achieve in early reading instruction (Schatschneider, Francis, Foonman, Fletcher, & Mehta, 1999), and that this awareness must include phonological structures smaller than the syllable, including onsets (i.e., beginning sounds and consonant clusters) and rimes (Anthony et al., 2003).

Vocabulary. The preceding three targets (viz, alphabet knowledge, print knowledge, phonological awareness) are causally associated with decoding achievement, whereas vocabulary is only modestly linked with decoding outcomes (see Scarborough, 2002, for review). Rather, the more direct contribution of vocabulary to reading is in the area of reading comprehension. Although the best predictor of reading comprehension is decoding ability (Lonigan, 2004), vocabulary is an additional source of variability in reading comprehension that must be directly addressed in Tier II interventions.

Design of Tier II emergent literacy intervention. Table 2 provides an overview of how second-tier instruction might be organized to accelerate the prereading development of children in the emergent literacy stage of development. Children who have been identified to receive Tier II intervention participate in two sessions weekly in a small group of 5 or 6 pupils. A standardized protocol of an activity sequence can be used to ensure dedicated attention to alphabet knowledge, print knowledge, phonological awareness, and vocabulary in each session. Whereas many different activities, curricula, and approaches may be used to develop standardized protocols for Tier II, what is most important is that these tools ensure the systematicity, explicitness, and intensity of instruction. *Systematicity* means that children are exposed to the full range of learning targets over the intervention period. *Explicitness* means that the educator's instructional intentions are transparent; pupils know what is expected of them, and feedback and support that inform students of how well they performed and what they accomplished are provided. *Intensity* means that specific literacy goals are addressed with sufficient regularity to accelerate development.

Using data from my own research on literacy intervention for 4-year-old children with SLI (Justice & Skibbe, 2005), I illustrate here how systematic, explicit, and intense intervention can accelerate the emergent reading development of preschoolers. Figure 3 shows growth in print concepts for children with SLI whose parents read to them four times weekly for a 3-month period while systematically and explicitly targeting print concepts within each session. We ensured the systematicity and explicitness of the reading interactions for these parents by identifying three print targets for each reading session (e.g., to differentiate print from pictures, to

point to the title of the book). The data in Figure 3 differentiate gains on a measure of print concepts ($M = 100$, $SD = 15$) for these children relative to a control sample of children with SLI whose parents read to them with the same intensity but did not systematically or explicitly include print targets in their reading sessions. Although both groups of children made gains in their print concept performance over the 3-month period, control children gained an average of 7 standard score points whereas the print-focused children gained an average of 13 points. These findings replicate those I have reported elsewhere (e.g., Justice & Ezell, 2002) and implicate the importance of explicit and systematic targeting of skills for slowly progressing learners.

The other high-priority emergent literacy objectives also require systematic, explicit, and intense intervention. Illustrations on how phonological awareness and vocabulary can be addressed in this manner are provided here. Figure 4 provides data from a supplemental tier of instruction that was provided to at-risk preschoolers, many of whom had SLI and concomitant behavioral difficulties (Justice, Chow, Capellini, Flanigan, & Colton, 2003). Growth in phonological awareness for these pupils is contrasted for two types of instructional conditions: an *explicit* condition in which children participated in a 6-hr (12 session) intervention that included systematic phonological awareness activities (e.g., matching words that rhyme, matching words sharing beginning sounds) and an *implicit* condition in which children participated in an intervention of the same intensity that did not include systematic and explicit attention to phonological awareness. As shown in Figure 4, children's growth in phonological awareness was accelerated when systematic and explicit attention was directed to phonological awareness development. Importantly, these gains were seen after only 6 hr of intervention.

Figure 5 provides an illustration of how vocabulary can be more systematically addressed in second-tier interventions. This study (Justice, Meier, & Walpole, 2005) provided a supplemental book-reading intervention for high-risk kindergartners and studied the kindergartners' learning of new words that occurred in the storybooks. Our goal was to determine if explicit vocabulary instruction had an advantage over implicit instruction for these pupils. Our explicit approach featured "elaborated exposure" of an a priori set of words that were unknown by the children, and when

Figure 3. Growth in print concepts for 4-year-olds with specific language impairment across two variations of 3-month home-based intervention: 48 print-focused reading sessions versus 48 picture-focused (control) sessions (Justice & Skibbe, 2005). Print concepts were measured with the Preschool Word and Print Awareness (Justice & Ezell, 2001) using standard scores presented in Justice, Bowles, and Skibbe (2006).

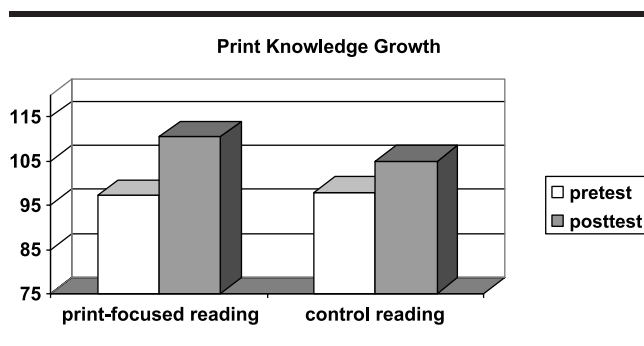


Figure 4. Growth in phonological awareness (rhyme production) for at-risk 4-year-olds across two variations of 6-week intervention: an explicit condition featuring systematic phonological awareness activities in each session and an implicit condition addressing phonological awareness within literature-based activities (from Justice, Chow, Capellini, Flanigan, & Colton, 2003).

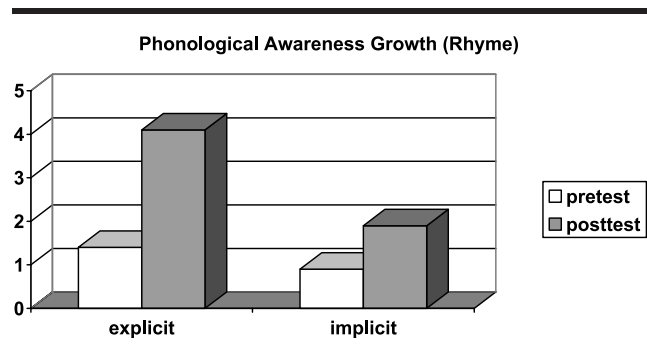
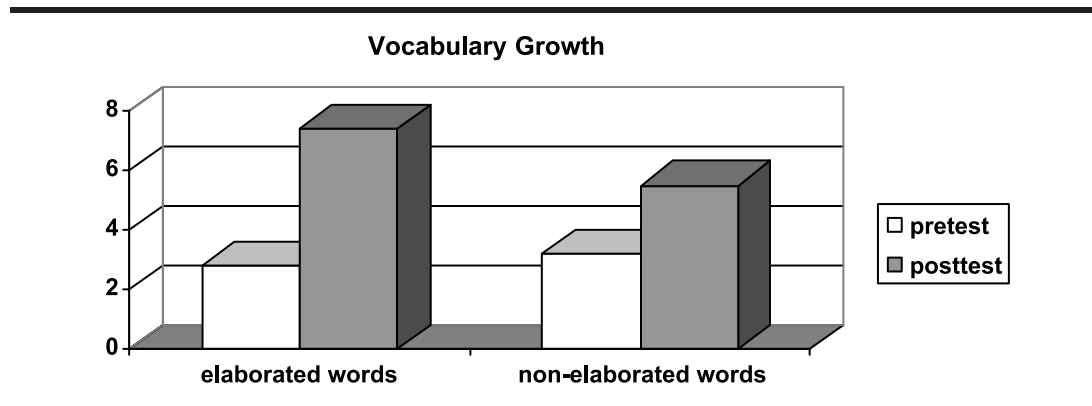


Figure 5. Vocabulary gains for at-risk kindergartners during a 20-session storybook reading intervention during which children were exposed to elaborated and non-elaborated words within each reading. Elaborated words were identified a priori by the interventionist and were defined and discussed during readings; non-elaborated words received no systematic attention (from Justice, Meier, & Walpole, 2005).



these occurred during the storybook reading, the interventionist paused to discuss these words—to define them, to give an example of their use, and to contextualize them for their role in the story. Figure 5 compares the children’s learning of these words (as measured by the accuracy of their definitions) to the children’s learning of words they heard only incidentally during the book readings. As in the illustrations provided from several previous studies (e.g., Justice & Skibbe, 2005; Justice et al., 2003), a systematic and explicit approach to instruction results in more vocabulary gains than does nonsystematic and implicit instruction.

High-priority targets: Early reading. Early reading (also called beginning reading and alphabetic reading) is the stage of reading development into which children transition when they have achieved the high-priority emergent literacy targets discussed in the previous sections. At the early reading stage, children begin to apply the alphabetic principle to recognize unfamiliar words. As they decode these words repeatedly during independent and/or guided reading, their internal store of sight words grows (i.e., words the child recognizes automatically without applying the alphabetic principle). Typically, early reading instruction, which occurs from the beginning of kindergarten to the end of second grade, emphasizes growth in word recognition. Children who are able to effortlessly, fluently, and automatically decode a large corpus of words are poised to transition to reading for meaning in third grade.

Targets addressed in supplemental Tier II interventions for children who fail to achieve adequately in Tier I early reading instruction are somewhat different than those addressed for children in the emergent literacy stage. These interventions emphasize the development of phonemic awareness, phonics, fluency, vocabulary, and reading comprehension (National Reading Panel [NRP], 2000). I recommend that readers consult the NRP report for a summary of the accumulated scientific evidence on effective approaches to addressing these goals in both Tier I and Tier II instruction. Here, I provide a brief definition of these high-priority second-tier targets and an overview of approaches to organize second-tier interventions.

Definition of targets. Tier II instruction for the early reader must attend comprehensively to five areas of reading development that represent domains of documented difficulty for struggling early readers (e.g., McMaster et al., 2005). *Phonemic awareness*,

a higher order achievement on the developmental continuum of phonological awareness, describes the child’s sensitivity to the sound structure of language, particularly the subsyllabic level of the phoneme. Phonemic awareness instruction focuses on teaching children to manipulate the phonemic elements of syllables and words—to blend them, to segment them, and to manipulate them.

Phonics, also called alphabetic knowledge, is the child’s knowledge of how letters are represented by sounds (e.g., F = /f/); it includes not only one-to-one letter-to-sound correspondence, but also the orthographic representation of various word families (e.g., AN, OUGH) and knowledge of specific orthographic rules (e.g., making syllabic juncture changes, such as WIN to WINNING). Effective phonics instruction features a systematic scope and sequence of these letter-to-sound patterns and orthographic rules. An excellent description of one instructional sequence is provided in Bear, Invernizzi, Templeton, and Johnston (2004).

Fluency is the child’s ability to read text automatically, efficiently, and without error. Fluency with a given text is aligned to a child’s level of decoding ability. A child is more fluent reading a text containing a large number of known orthographic patterns (termed decodable text) and is less fluent when the text contains less familiar or more challenging orthographic patterns. Children’s fluency in reading is supported by daily experiences reading familiar and decodable texts independently and guided reading of instructional-level text (text that is slightly challenging in its orthographic content).

Vocabulary is the child’s internal store of word meanings, as SLPs are well aware. Reading researchers use the term “reading vocabulary” to describe words that children encounter when reading text, which they must map onto words contained in their oral vocabulary (NRP, 2000).

Reading comprehension is the child’s ability to understand what is read. Although it draws on the same processes and skills involved with oral language comprehension, reading comprehension also requires that the child be able to shift resources from word recognition to meaning and to use *comprehension strategies* to detect logical and semantic consistencies and inconsistencies in texts (NRP, 2000). Reading comprehension is a more intentional behavior relative to language comprehension. To comprehend text, readers must engage in an intentional, problem-solving, and thinking process as they interact with a text (NRP, 2000). Comprehension instruction

emphasizes the development of systematic strategies used to comprehend a variety of texts, such as monitoring one's own comprehension, organizing textual context graphically, and analyzing the expository structure of texts.

Design of Tier II early literacy interventions. Several recent studies (e.g., Vaughn et al., 2003; Vellutino et al., 1996) provide evidence-based guidance on the design of Tier II supplemental interventions for struggling early readers (kindergarten to second grade). A recent volume (Foorman, 2003) summarizes many of these studies. These interventions typically feature delivery of a supplemental 100- to 120-min weekly one-on-one or small-group instruction to struggling students for extended blocks of time (Vaughn et al., 2003). Pupils' progress during the supplemental intervention is carefully monitored. When criterion-level benchmarks are reached, the children may be discharged from the second tier; thus, not all children will require the second tier for the entire academic year. As an example, in Vaughn et al.'s implementation of second-tier intervention for 45 struggling second graders, 10 and 14 pupils met criterion-level goals after 10 and 20 weeks of intervention, respectively; only 2 of these 24 pupils were unable to maintain their reading achievements when the second tier was withdrawn. Moreover, of the 45 second graders who received the additional tier, only 11 did not achieve benchmarks by the end of the 30-week intervention; put another way, the second-tier supplement effectively remediated the reading deficits of 75% of the students.

The delivery of second-tier supplemental reading interventions to struggling early readers often follows a standardized protocol in which each lesson features a set series of activities that are provided to all children in the group (e.g., McMaster et al., 2005; Schuele et al., 2005; Vaughn et al., 2002; Vellutino et al., 2003). As an example, Vellutino et al.'s second-tier intervention for first graders provided daily one-on-one 30-min sessions with the following sequence of activities:

1. Rereading of a familiar (independent-level) text (target: fluency)
2. Phonemic awareness activity (target: phonemic awareness)
3. Sight word identification activity (target: fluency)
4. Phonics/word-study instruction (target: phonics)
5. Guided reading of instructional-level text (target: vocabulary, reading comprehension)

Vellutino et al. (2003) provided this intervention to 45 struggling first graders who did not pass a fall literacy screening; these 45 children had already received a comprehensive and systematic supplemental tier of instruction in kindergarten, but had failed to respond. More than half of these pupils (58%) achieved grade-level reading performance by the end of third grade, showing that intensive, ongoing, and multitiered preventive interventions can prevent a good proportion of struggling readers from developing RD.

Importantly, the accumulated evidence suggests that when second-tier interventions are delivered proactively and intensively in preschool or kindergarten and extend to first and second grade for those children who show treatment resistance, between 2% and 5% of children will remain poor readers in second and third grade (Torgesen, 2000). It is these children who truly have RD, indicated by their failure to respond to ongoing multitiered reading interventions. Importantly, in RTI models, the vast majority of children with significant vulnerability for reading difficulties can meet

grade-level expectations with intensive, systematic, and explicit supplemental interventions; participation in these interventions differentiates these at-risk children from those who truly have RD.

CONCLUSION

The need for early and intensive multitiered intervention programs is proven by the scientific literature showing that the reading difficulties of a large majority of pupils can be prevented if early and intensive interventions are provided (e.g., Vellutino et al., 2003). In the third section of this article, I presented three principles of practice concerning how RTI models might be organized in schools, with an emphasis on the role of the SLP. Although SLPs have been encouraged to embed reading-related targets within their clinical interventions for pupils with speech-language disorders, my contention is that such efforts will have relatively little impact on our pupils' reading trajectory. Rather, the accumulated literature shows that intense and systematic supplemental interventions are needed to accelerate the reading growth of struggling learners (Foorman, 2003). SLPs can best serve their pupils, and a more general population of at-risk students within their schools, by helping to design and deliver multitiered preventive reading programs from preschool onward. SLPs can perform such critical roles as (a) collaborating with school professionals (classroom teachers, special educators, reading specialists, etc.) to audit the Tier I learning environment for preschool, kindergarten, and elementary reading instruction; (b) designing interventions and approaches to improve Tier I instruction; (c) administering progress monitoring assessments to identify children who require additional tiers of reading instruction; and (d) delivering Tier II interventions for at-risk pupils. The initiative for systematic and sustained prereferral activities such as these will ultimately reduce the number of pupils requiring special education services in reading and related areas. SLPs who adhere to the principle that prevention is more powerful than remediation have important roles to play in organizing and supporting reading interventions with an RTI model.

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APPENDIX. QUALITY INDICATORS FOR FIRST-TIER READING INSTRUCTION: PREK TO G2

PreK to K	<p>Core curriculum with systematic 180-day map for emergent reading targets:</p> <ul style="list-style-type: none"> Alphabet knowledge Print knowledge Phonological awareness Language comprehension Vocabulary <p>Literacy-rich general environment:</p> <ul style="list-style-type: none"> Child-generated print displays Books in a variety of niches Functional print displays Literacy models (e.g., alphabet display) <p>Literacy-rich classroom centers:</p> <ul style="list-style-type: none"> Library center Writing center Dramatic play center Science and math center <p>Classroom schedule providing:</p> <ul style="list-style-type: none"> Large-group instruction Small-group differentiated instruction One-on-one instruction Daily large-group reading instruction Daily writing instruction <p>Data collection for student achievement:</p> <ul style="list-style-type: none"> Benchmark achievement in fall, spring Periodic progress monitoring assessments
G1 to G2	<p>Core curriculum with systematic 180-day map for reading targets:</p> <ul style="list-style-type: none"> Phonemic awareness Word study/phonics Reading comprehension Vocabulary Fluency <p>Literacy-rich general environment:</p> <ul style="list-style-type: none"> Child-generated print displays Books suitable to a variety of reading levels Functional print displays Literacy models (e.g., word wall) <p>Literacy-rich classroom centers:</p> <ul style="list-style-type: none"> Library center Writing center <p>Classroom schedule providing:</p> <ul style="list-style-type: none"> Protected time for reading instruction (90-min plus) Differentiated instruction in flexible groupings Data collection for student achievement Benchmark achievement in fall, spring Periodic progress monitoring assessments

Note. Sources include Justice & Kaderavek, 2004; Kame'enui, Simmons, & Coyne, 2000; National Reading Panel, 2000; Smith & Dickinson, 2002.