

Increasing the Intensity of Intervention in Kindergarten and First Grade

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Children entering kindergarten who are at risk for reading problems may require a “jump-start,” in the form of specialized instruction, to improve their prognosis for reading acquisition. Four layers of intervention are described, in which a series of interventions targeted kindergarten and first-grade children who have not benefited from previous treatments. These layers of intervention were implemented over a period of 2 years, and this article discusses and evaluates their effects on children’s reading acquisition.

Abstract. *In this study, a team of university and school personnel applied layers of intervention across 2 years to students who fell below their class averages in reading skills at various measurement cycles across kindergarten and first grade. Their goal was to reduce the proportion of children who make minimal reading progress and to explore interventions for very hard-to-teach children, particularly that group variously labeled nonresponders or treatment resisters. Studies supported by the National Institutes of Health suggested more intense intervention; however, this was precluded by limited funds. Schools used available resources to intensify instruction for children struggling to acquire basic literacy. Although reading failure rates declined among students who received additional instruction, the interventions did not significantly decrease the proportion of children identified for special education.*

There is indisputable evidence that the reading, writing, and spelling difficulties of most children who struggle to learn to read are related to a deficit in phonological language skills (e.g., Rack, Snowling, & Olson, 1992; Share & Stanovich, 1995; Torgesen, Wagner, Rashotte, Burgess, & Hecht,

1997). Phonological skills enable students to make sense of the sound attributes of spoken and written words; **most prominent among them are the abilities to blend and segment the sounds of spoken words—for example, to segment cat into the individual sounds (/k/ /a/ /t/), or phonemes, that comprise the word.** Evidence supporting a deficiency in phonological skills for most disabled readers comes from several sources: cross-sectional comparisons of age-matched and reading-ability-matched poor and normal readers (Stanovich, Nathan, & Zolman, 1988; Vellutino & Scanlon, 1987), longitudinal studies indicating the importance of phonemic segmentation ability to reading development (Bradley & Bryant, 1983; Wagner et al., 1997), and treatment studies indicating that improving phonological awareness facilitates success in acquisition of the alphabetic principle and word identification (Ball & Blachman, 1991; Blachman, Ball, Black, & Tangel, 1994; Bradley & Bryant, 1985; Byrne & Fielding-Barnsley, 1993; Foorman, Francis, Fletcher, Schatschneider, & Mehta, 1998; Hatcher, Hulme, & Ellis, 1994).

Most children formally enter the public or private school system in kindergarten, which makes the kindergarten year a particularly good time to begin preventive measures and to stimulate the kinds of knowledge and skills likely to promote reading acquisition. Controlled experiments in which researchers taught phonological blending and segmenting to young children report positive treatment effects. Nevertheless, several researchers in the last few years also have reported learning difficul-

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ties for 20% to 30% of the children in the intervention, such that some children made little, if any, measurable gain in the skills that were included in instruction. Moreover, many of these studies exempted children who had been identified for special education services or who had behavioral problems (e.g., Hatcher et al., 1994; Vellutino et al., 1996), so that the very hardest to teach children may have been excluded from participation in the treatments.

Layer 1 in kindergarten might "jump-start" these skills among children who lacked exposure and opportunity and assist in identifying children who may be more "truly" reading disabled.

This study was designed to explore both of these issues. First, in urban or low socioeconomic areas, where reading failure is a serious problem, all potential readers should be included in interventions as needed. That meant including children with behavioral and attention difficulties, with cognitive challenges (vocabulary scores < 75 on standardized measures), and with diagnosed disabilities. It seemed possible that if these very hard to teach children were included in the treatments, there might be even more poor responders than the 20% to 30% reported by other researchers. Regardless, including students with disabilities or attention and behavior problems should provide a more realistic estimate of the effects of intervention on preventing the reading problems of young children. Second, one-time interventions simply may be too short to fully remediate reading problems for students with severe learning difficulties. Therefore, this study included a series of interventions in which students could be included, as needed, over the course of the first 2 years of school.

This article describes that series of reading interventions and their effects on reducing serious reading acquisition problems. The layered approach to intervention began with changes in the general education kindergarten curriculum. In the previous 2 years, kindergarten teachers had participated in a study in which they all used the same district-provided curriculum. Half of the teachers also used the activities in *Ladders to Literacy* (O'Connor, Notari-Syverson, & Vadasy, 1998b) to increase the amount of phonological awareness instruction in the general classroom and to increase their focus on the sounds that letters make. Children in these classes achieved higher end-of-kindergarten outcomes than did control classes (O'Connor, Notari-Syverson, & Vadasy, 1996) and higher first-grade outcomes for children who began kindergarten with very low skill levels, including those with disabilities (O'Connor, Notari-Syverson, & Vadasy, 1998a). Despite statistically significant improved performance of the group, some of the low-skilled children made only minimal gains.

The children who participated in this study reside in a large urban school district in which more than 50% of the children qualify for remedial services in reading at some point during the elementary years, approximately 40% of the children have sustained reading problems throughout their school career, and 13% qualify for special education by fourth grade. I hoped that intervention in phonological awareness, letter knowledge, and letter sound decoding might improve their prognosis for reading acquisition; however, earlier studies reported learning difficulties for some children on these intervention tasks (O'Connor & Jenkins, 1995; O'Connor, Jenkins, Slocum, & Leicester, 1993; O'Connor et al., 1996; O'Connor et al., 1998a, 1998b; see also Blachman, 1994; Torgesen, Morgan, & Davis, 1992; Torgesen, Wagner, & Rashotte, 1994, 1997).

To monitor instructional effects, the school-university team measured the progress of children in literacy at nine points across kindergarten and first grade to identify the children who were not responding well to the activities delivered by the general class teacher to the whole class. At each measurement cycle we identified the average attainment of skills and used what most children could do in reading and spelling to structure more intense intervention aimed at assisting other children who struggled with reading acquisition to be able to do the same things. Thus, as the type and level of skills changed for the entire sample, we changed the content of successive interventions to reflect age-appropriate reading development. We wanted to explore the effect of various types and intensities of interventions on learning key literacy skills. We were also curious about characteristics of children that might predict those who would respond less well to treatments at particular layers of intervention and how special education interfaced with the larger proportion of children who fail to acquire adequate reading ability in this district.

The design included early identification and subsequent intervention with children who seemed likely to develop reading disability. As Torgesen (this issue/2000) explains, many factors influence the course of reading development, but studies have identified particular factors that appear necessary for promoting reading acquisition. Unfortunately, many of these supporting factors are also associated with economic advantages, so it can be difficult to distinguish children with reading disability from children whose difficulties are caused by inadequate schooling or limited exposure to reading activities prior to kindergarten.

INCREASING INTENSITY OF INTERVENTION ACROSS KINDERGARTEN AND FIRST GRADE

The first layer of intervention was designed to teach children who might not enter kindergarten with

well-developed preliteracy skills some of the skills that appear to contribute to reading acquisition in first grade, such as letter knowledge, phonological blending and segmenting, and speaking and listening vocabulary. We supposed that Layer 1 in kindergarten might “jump-start” these skills among children who lacked exposure and opportunity and assist in identifying children who may be more “truly” reading disabled. Next, we followed the progress of all the kindergartners in letter naming and segmentation to identify children who were not responding well to these whole-class activities. For children who made poor gains between October and January, we designed a second layer of intervention, while continuing whole-class instruction for these and all other children. Layer 2 reinforced the same activities that the general class teacher used with the large group, but it delivered the activities in short, focused sessions that allowed more individual support. In first grade, we continued to monitor literacy progress and added small-group instruction in phonological segmenting and blending in conjunction with small sets of decodable words (Layer 3) for children with standard scores below 86 on the combined letter–word identification and dictation subtests of the Woodcock–Johnson Tests of Achievement (WJ; Woodcock & Johnson, 1990). In March, we selected 12 children whose reading skills were still below average to participate in Layer 4, in which we conducted blending, word reading, and spelling activities around a small core of known letter sounds. As we increased the intensity of intervention, we tried to keep feasibility in mind, considering a public school setting with limited funding to assist children ineligible for special services. Specific activities in each layer of intervention and the results on children’s reading growth are described in the following sections.

SELECTING CHILDREN AT RISK

A total of 189 children from eight kindergartens in three schools in an urban district in the Northeast participated in this study. By the end of first grade, 146 children were still available for testing. Most of the attrition was due to families moving out of the participating school districts.

Overall, 70% of the children received free or reduced lunch (our proxy for socioeconomic status of the families), with more than 90% in the largest school. Across the three schools, 44% to 73% of the children were African American, with the remainder in each school being European American. There were no other ethnic groups represented by more than 1% of the school population. Children ranged in age from 4.8 to 7.1 years old in October of kindergarten.

In October, we screened the kindergartners with measures of vocabulary, letter identification, short-term

memory for sounds, rapid naming of animals, rhyme production, syllable deletion, phonological blending and segmenting, reading, and dictation. We used an “at risk” selection process based on a prediction study in which these measures accurately identified children who had a reading disability 2 years later, with an overprediction rate of approximately 12%. Cutoff scores on these measures identified 59 children, or 40%, as likely candidates for reading problems—a proportion close to that identified for the school district overall in the intermediate grades. Children selected as at risk named fewer than 15 letters in 1 min, segmented fewer than four segments in 10 three-phoneme words, and had standard scores below 86 on the combined letter–word and dictation subtests of the WJ. Criteria for selecting children at risk for reading difficulties for each intervention layer are shown in Table 1. Although the selection criteria in October of kindergarten overidentify children, especially among children from poor families, they rarely miss children who later develop reading disability (O’Connor & Jenkins, 1999). As children progress through first grade, we can measure more real reading (e.g., word identification and oral reading fluency) than we can in kindergarten (letter identification and phonological awareness skills). Table 1 shows the way in which selection criteria changed over time.

The first layer of intervention consisted of whole-class, teacher-led activities and games that encouraged children to attend to the sounds in spoken words, learn letter names and sounds, and develop speaking and listening vocabulary.

The remaining layers of intervention described in this article addressed the reading progress of this subset of high-risk children. In October of kindergarten, only 2 of the 59 children at risk had been identified for special services: one with mild mental retardation (MMR) and one with severe emotional disturbance (SED). Nevertheless, the 59 selected children performed significantly lower than the nonselected children on every measured dimension except age (Wilks’s $\Lambda = 0.467$), $F(11, 134) = 11.78, p < .01$. Scores on the October measures for children at risk and others are shown in Table 2. Because the score on rapid animal naming is the number of seconds it takes children to name animals and colors on a card, a higher score reflects poorer performance.

All eight classes participated in Layer 1; we increased the intensity of instruction through subsequent layers of intervention with subsets of this initially selected sample of 59 children. Figure 1 shows the declining proportion of children who met the criteria for at risk at key measurement cycles. Because this figure includes children who were classified as at risk for reading problems but did not receive additional intervention (primarily due to declin-

TABLE 1
Criteria for Classification of Risk Status and Response to Treatment for Each Layer

	Criteria for Classification		
	Selection for Treatment	Poor Response	Leaving "At Risk" Category
Layer 1 Kindergarten—all year, for all kindergartners	In October: WJ < 86, and segment < 4, and letter naming < 15		
Layer 2 Kindergarten—January	WJ < 86, and segment < 4, and letter naming < 15	Segment gain < 13, letter naming gain < 12	WJ > 85
Layer 3 Grade 1—October	WJ < 86	Blending gain < 2, segment gain < 9	WJ > 85
Layer 4 Grade 1—March	Poor response to Layer 3, or WJ < 86, or has a disability	WJ < 86	WJ > 85

Note. WJ = Standard scores for Woodcock–Johnson literacy subtests (Letter–Word Identification and Dictation in kindergarten, plus Word Attack in Grade 1).

ing permission to participate), these proportions probably overestimate what we could achieve if resources were extended to all high-risk children.

LAYER 1: LADDERS TO LITERACY

The first layer of intervention consisted of whole-class, teacher-led activities and games that encouraged children to attend to the sounds in spoken words, learn letter names and sounds, and develop speaking and listening vocabulary. These activities were drawn from *Ladders to Literacy* (O'Connor et al., 1998b), which has significantly improved the early literacy skills of children with special needs and children from low-income families in previous studies (O'Connor et al., 1996, 1998a). Between October and January, children participated in games that included syllable clapping, recognizing and generating rhyming words, and blending and segmenting onsets and rimes. Measures of rapid letter naming and segmenting (Kaminski & Good, 1996) were collected again in November and January. By January, most of the children had learned over half the letter names, learned to recognize classmates' names in print, and could isolate the first sound in spoken words.

Following the January testing cycle, we found that Layer 1 was sufficient literacy stimulation for 15 children who originally had been selected as at risk, reducing the number of children who continued to fall significantly behind their peers to 44 (30% of the entire cohort). We classified these children as poor responders to whole-class instruction in blending and segmenting

(i.e., segment < 4; rapid letter naming < 15). By January, one more child at risk had been identified for special education services in the area of speech and language processing (learning disabilities). The average October scores for children at risk were very low (three letters named and one segment produced); however, some children responded as early as November in segmenting and letter naming. That 25% of the sample at risk made rapid growth supports the recommendations of Blachman (1994) and Adams and Bruck (1995) that children from high-risk populations should receive instruction to stimulate phonological awareness prior to identification for remedial services.

Increasing the Intensity of Instruction

In selecting children to offer Layer 2 intervention, we began with the selection criteria in Table 1, which identified 44 children, and we then requested the assistance of their teachers. For the 31 children whose teachers were willing to cooperate in orchestrating additional intervention, we were able to secure parent permission for 25 children. We particularly wanted to include children with disabilities, and all 3 of the children identified thus far for special services participated.

By February, when Layer 2 began, the whole-class activities encouraged blending and segmenting three- and four-phoneme words, matching letters to sounds in words, invented spelling, and vocabulary to build descriptive language. In all, teachers conducted at least 90

TABLE 2
Means and Standard Deviations of Children in Layers 1 and 2 Across Kindergarten

Measures	Not At Risk ^a		At Risk ^b					
	M	SD	M	SD				
October								
Age	5.3	0.3	5.2	0.6				
PPVT-R	95.3	17.1	88.9	10.7				
Sound repetition	7.5	2.4	7.0	2.3				
Rapid animal naming	144.8	68.6	189.3	71.4				
Rapid letter naming	16.4	13.2	2.5	2.9				
Blending	2.9	3.1	1.6	2.4				
Segmenting	1.7	3.8	0.8	1.4				
Syllable deletion	4.6	3.9	2.9	3.4				
Rhyme production	2.3	3.5	1.6	2.8				
WJ Letter-word	95.3	10.3	79.7	6.5				
WJ Dictation	91.2	12.5	74.2	10.1				
At Risk								
Measures	Not At Risk ^c		Layers 1 & 2 ^d		Layer 1 Only ^e			
	M	SD	M	SD	M	SD		
January								
Rapid letter naming	31.6	13.0	3.4	2.7	3.7	3.3		
Segmenting	6.5	5.7	1.1	1.9	1.0	1.6		
At Risk								
Measures	Not At Risk ^c		High Gain ^f		Low Gain ^g		Layer 1 Only ^h	
	M	SD	M	SD	M	SD	M	SD
May								
Rapid letter naming	43.2	13.5	19.9	9.8	14.3	12.5	17.8	11.2
Segmenting	19.8	10.8	18.5	9.1	6.6	3.4	8.2	9.3
Blending	13.4	5.8	11.7	5.8	4.9	3.3	5.2	5.2
WJ Letter-word	100.8	11.6	89.4	6.2	78.3	8.3	80.8	7.3
WJ Dictation	105.2	8.8	97.6	7.8	86.5	6.2	87.0	12.3
Spelling	17.3	14.7	6.0	6.4	1.3	2.4	1.6	3.2

Note. Rapid animal naming is scored by the number of seconds a child takes to name 24 instances of three randomly arranged and colored animals. Rapid letter naming is the number of correctly named letters per minute. Spelling is a developmental score, based on 6 points per word (Tangel & Blachman, 1992). PPVT-R = Peabody Picture Vocabulary Test-Revised (Dunn & Dunn, 1981); WJ = Woodcock-Johnson Tests of Achievement, standardized scores.

^a*n* = 87. ^b*n* = 59. ^c*n* = 102. ^d*n* = 25. ^e*n* = 19. ^f*n* = 18. ^g*n* = 7.

short sessions across the year (e.g., three or more times per week) of Layer 1 activities.

LAYER 2

Classroom observations revealed that many of the children who made poor progress in the first months of Layer 1 also had poor attention during large-group activities. Layer 2 provided 25 children with one-to-one tutoring using activities that were similar to those used during the same months by their teachers with the whole group. We hoped that individual attention might help children to focus on the tasks and make faster progress. We scheduled 12-min sessions three times per week for 10 weeks, February through April, using teacher assis-

tants (general class personnel) as instructors in most classes and a research associate in one class that had no teacher assistant time provided by the school. The lesson format included cumulative introduction of letter names and sounds for 2 to 4 min, followed by alternated blending and segmenting activities at the level of onset and rime. Children matched letter sounds to words and used say-it-and-move-it activities (Ball & Blachman, 1991). As children learned the eight letter sounds and onset-rime level blending and segmenting, activities changed to three-phoneme blending and segmenting, but just over half the children reached that level by the time Layer 2 ended.

One-to-one instruction provided several advantages beyond focusing attention. First, we were able to offer

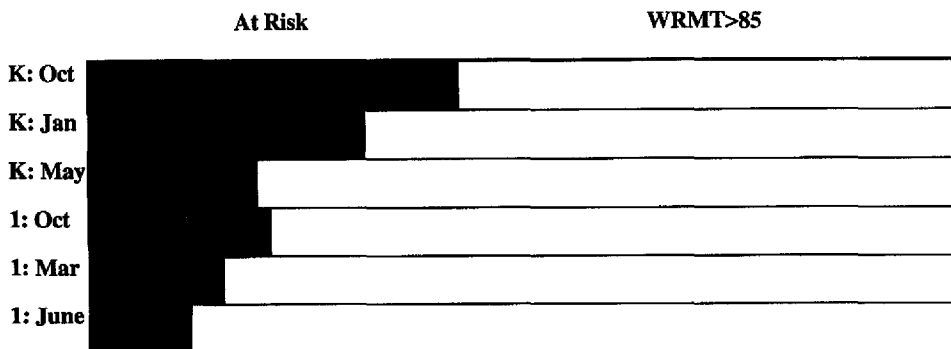


FIGURE 1 Percentage of children at risk across 2 years ($N = 146$).

many more repetitions on the critical tasks. For example, we could ensure that children thoroughly knew their small set of letters before adding a new one. We decreased the difficulty of blending and segmenting games by reducing the size of the set, physically prompting responses, and reviewing new learning frequently. For example, in "Guess the Word," a blending game, the kindergarten teacher used 5 to 10 pictures or objects, for which the class was usually given one or two repetitions. For children having difficulty with the abstract nature of the blending task, we showed only 3 objects or pictures in Layer 2 and gave the children many repetitions until they were consistently correct. As a child became more competent, we increased the number of words and eventually removed concrete representations altogether.

In thinking about this additional layer, it is important to keep in mind that all the children continued to receive Layer 1 throughout kindergarten, and so the 19 low-skilled children who did not receive Layer 2 still received treatment. Moreover, the teachers in these classes had been in the control group in an earlier study (O'Connor et al., 1996), and so we could reasonably compare performance of children in Layer 1 with children in previous years taught by the same teachers using the same general class curriculum, but without the Layer 1 activities. The average performance (i.e., WJ scores, blending, segmenting) of children at risk who only received Layer 1 surpassed that of children in previous years prior to the implementation of the phonological awareness activities.

Outcomes for Layer 2

Comparing scores of children at risk who received Layers 1 and 2, or only Layer 1, multivariate analysis of variance (MANOVA) revealed significant differences on the May measures (Wilks's $\Lambda = 0.604$), $p < .05$, with univariate follow-up tests pinpointing significant differences in blending, segmenting, combined WJ scores, and developmental spelling, $F_s(1, 42) = 6.436, 7.771, 4.599$, and 3.979 , re-

spectively. By the end of Layer 2, 13 of the 25 participants scored above 85 on the combined WJ subtests, which shifted them out of the high-risk category.

We used the average segmenting gains from January through April of children not at risk as a benchmark for strong gains (13 segments per min). Functionally, scores higher than 10 ensured that students could segment past the first sound in a list of 10 spoken words. Despite significant differences attributable to Layer 2, 7 children in this intervention (including the child with MMR) did not make gains this large in blending and segmenting (see low gain group in Table 2). Thus, among our students who had received continuous intervention, 28% responded poorly.¹ Table 2 shows scores for strong and weak responders in Layer 2.

LAYER 3: GRADE 1 SMALL GROUPS

In first grade, we measured children's progress in October, January, March, and May, and we identified 30 children (21% of the sample) reading one or more standard deviations below the mean on the combined WJ measures. Three of these children moved outside of the participating schools, and, although we continued to collect measures, we were unable to intervene in their reading instruction. One of the first-grade teachers and five parents declined permission to participate, and so Layer 3 intervention was conducted for only 20 of the children still at risk, including 12 who had participated in Layer 2 (the 7 who had responded poorly, plus 5 children who responded well but whose standard scores on the WJ fell below 86 in October), and 8 children from

¹Because two teachers and six parents declined participation in Layer 2, our sample of students who received all treatments for which they qualified was reduced to 127. Of these 127 students, 14 (11%) had standard scores below 86 on their end-of-kindergarten WJ tests.

TABLE 3
Means and Standard Deviations of Children in Layers 3 and 4 Across First Grade

Measures	<i>Not At Risk^a</i>		<i>At Risk^b</i>		<i>Layer 3^c</i>					
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>High Gain^d</i>		<i>Low Gain^e</i>		<i>No Extra Layer^f</i>	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
October										
Rapid letter naming	46.4	11.2	24.6	16.5						
Blending	15.6	4.8	9.1	4.2						
Segmenting	26.1	12.3	11.6	14.5						
WJ subtests	103.3	11.5	79.3	8.6						
Spelling	29.2	14.3	8.9	8.5						
March										
Rapid letter naming	53.1	17.8	38.3	9.8	28.8	14.2	28.8	20.8		
Blending	17.6	1.9	12.2	3.7	9.0	2.2	7.0	2.9		
Segmenting	35.3	10.5	23.9	5.0	12.5	3.1	9.3	3.1		
Spelling	33.3	12.3	24.1	10.5	15.3	8.6	13.4	11.3		
WJ subtests	106.1	11.9	88.7	11.5	82.4	4.3	76.1	8.3		
Reading fluency	21.7	16.4	11.5	9.1	5.8	4.4	2.8	3.1		
May										
Rapid letter naming	59.9	11.3	45.0	13.9	33.8	15.6	31.2	11.8		
Blending	17.9	1.7	17.3	2.1	13.8	5.3	8.8	4.2		
Segmenting	36.6	10.6	36.7	4.8	23.5	11.4	12.3	14.8		
WJ Letter-word	111.7	13.1	95.7	8.8	82.0	3.8	80.6	8.2		
WJ Dictation	106.3	10.9	94.4	8.5	78.5	7.2	79.9	9.4		
WJ Attack	112.1	13.0	96.1	11.7	84.7	5.2	82.8	5.9		
Spelling	48.1	11.2	45.2	8.5	22.3	15.7	18.5	13.8		
Reading fluency	37.1	24.6	19.5	7.3	9.1	5.6	3.2	5.4		

Note. Rapid letter naming is the number of correctly named letters per minute. Spelling is a developmental score, based on 6 points per word (Tangel & Blachman, 1992). WJ = Woodcock-Johnson Tests of Achievement, standardized scores.

^a*n* = 116. ^b*n* = 30. ^c*n* = 20. ^d*n* = 14. ^e*n* = 6. ^f*n* = 10. ^g*n* = 12. ^h*n* = 124. ⁱ*n* = 6.

Layer 1 (5 who had responded poorly, and 3 who responded well but slipped back into the high-risk category in first grade; see Table 3).

General Class Instruction

One of the participating teachers used a conspicuous code emphasis approach to instruction in first grade, and most described their programs as balanced. Reading activities included large-group discussion to build vocabulary and comprehension, choral reading of Big Books, writing in journals, occasional word analysis activities, and independent silent reading. One school relied on trade books for small-group round-robin reading, discussion, and writing activities. Other classes

used the Macmillan-McGraw-Hill reading series (The Macmillan/McGraw-Hill Reading/Language Arts Program, 1993), which emphasized high-frequency words. Reading and language arts were conducted for 60 to 80 min four to five times each week. In addition to general class instruction, 5 of the Layer 3 participants received 20 to 30 min of additional reading practice two to three times weekly with their special educator.

Layer 3 Intervention

Instruction occurred in groups of three to five children in 30-min sessions four times each week for 14 weeks beginning in November. In all but one class, this 30 min supplanted some of the silent reading time. A first-grade

general class teacher, who was also a graduate student at the university, conducted these lessons for two of the classes, and a graduate student in special education who was student-teaching in the school conducted the other three groups.

Lessons began with a review of letter sounds and introduction of two new sounds each week. Next, children used phonetic decoding and blending to read a set of words that included letter sounds from the instructional set. We started with two- and three-letter words in November, and by January we included words with consonant blends and vowel combinations. After the group read the new words, one letter or letter combination in each word was changed to create a new word. Next, children wrote some of the dictated words in journals. For the last half of each lesson, children read books that contained many of the taught letter sounds and patterns. In addition to these 30-min lessons, children participated in about half of the whole-class reading instruction.

Outcomes for Layer 3

A MANOVA by treatment on scores from the March measures for children at risk in Grade 1 who did or did not participate in Layer 3 was significant (Wilks's $\Lambda = 0.390$), $p < .01$, with significant improvement on blending and segmenting, on the subtests of the WJ, on oral reading fluency, and on developmental spelling. Nevertheless, 6 of the treated children (30%) made only minimal progress (i.e., segment gain < 9 and blending gain < 2 , which was the average growth of children not at risk). The resulting scores for these weak responders reflect inability to segment or blend three-phoneme words and no functional reading fluency (average oral reading rate of six words per min). Four of these 6 children also made minimal gains in Layer 2. Of the 14 students who made strong gains (more than the average gain of the typical readers during the intervention months), 4 still continued to fall into the high-risk category because their beginning skill levels were very low (i.e., combined WJ scores ranged from 61 to 77 in October).

Most children in Layer 3 learned to segment, but those who remained poor readers had particular difficulty learning to blend letter sounds into words, even though their segmenting skill approached average performance. Moreover, although letter sound knowledge improved, their rate of improvement on naming letters and sounds lost ground in respect to the growth of typical readers.

LAYER 4: ONE-TO-ONE BLENDING AND SPELLING

Following screening in early March (blending, segmenting, rapid letter naming, oral reading fluency, and spelling), we selected the 6 students from Layer 3 who

had made poor literacy progress and the 4 who had made good gains but remained below 86 on the WJ for continued intervention. We added to this group 2 students with disabilities (one with MMR and one with LD) who had received continuous layers of intervention and made better-than-average growth in Layer 3 (WJ scores of 89 and 104, respectively). Although these 2 children fell within the average range on the WJ subtests, their rate of progress had decreased in the phases between the layers of intervention. Thus, we determined that additional intervention was necessary for these students to maintain adequate growth in literacy. Despite the fact that they received all previous layers of intervention, blending scores for the 12 children in Layer 4 remained significantly below average performance, $F(1, 135) = 9.937$, $p < .01$.

Layer 4 Intervention

The focus of this layer was blending and spelling decodable words. Unlike in the other layers, two research personnel conducted all instruction. Children met one-on-one with a researcher for 15-min sessions, four times per week, for 4 weeks. Children began each session with a few minutes of letter sound instruction and practice, in which children learned the most common sound for unknown letters and practiced known letter sounds to increase their decoding speed. Next, children learned to sound out words composed of two to five letters with known letter sounds. They also practiced rapidly reading the words they had successfully decoded. Last, they spelled some of the words they already had read using a segment-to-spell strategy and then read back the words they had written.

After 4 weeks of instruction, the children were tested on phonological blending and segmenting, oral reading fluency, spelling, and the reading subtests of the WJ. A MANOVA between high-risk children who did or did not receive Layer 4 was significant (Wilks's $\Lambda = 0.417$), $p < .05$, with all univariate comparisons significant except dictation. Among the six children who reached "average" reading (scores > 85 on the combined WJ subtests) were four students with disabilities: three with LD (one diagnosed in kindergarten, one in first grade, and one the following year in second grade); and one child with MMR (diagnosed in kindergarten). Of the six poor responders, all were diagnosed with high-incidence disabilities by the end of Grade 2 (three with LD, one with MMR, two with SED).

DISCUSSION

This study was directed at early detection and intervention for children with disabilities and reading acquisi-

tion difficulties and spanned a layered intervention period of 2 years that provided a “first line of defense” by increasing the intensity of reading instruction as needed. These interventions were targeted toward the skills at each layer that differed most from the average achievers. Interventions highlighted phonological skills and letter knowledge in mid-kindergarten, phonological skills and word reading early in first grade, and phonological decoding and spelling toward the end of first grade. By first teaching children in whole-group lessons, then intervening in smaller groups, and then using short-term one-to-one instruction, we attempted to design intervention techniques that would be feasible in general and special education settings.

For the children with disabilities, attaining threshold levels of phonological segmentation and letter naming was useful but insufficient to ensure adequate reading progress across the 2 years of this study.

Determining Response to Treatment

Overall, children in each layer of intervention progressed significantly better in target skills and reading and spelling than did children beginning at similar skill levels who did not receive that layer of intervention. We defined strong response as growth in the target skills that matched or exceeded growth of the average learners over the same period of time, and as children reached the average range ($SS > 85$) on the WJ, we reclassified them as not at risk. Children could make strong growth and still fall below the average band in literacy if their skills were very low to start with or if they grew at a slower rate in between the layers of intervention. For example, a child might make greater gain in segmenting during Layer 2 than average children and be classified as a “strong grower.” Layer 2 ended at the end of April, however, and Layer 3 did not begin until the following November. During that time, “average” readers continued to grow in reading ability, whereas some strong growers from Layer 2 showed only small gains during the 6 months between Layers 2 and 3, and so they still did not catch up with the average readers. Indeed, nine children with disabilities who received specialized support in all layers of intervention were still very poor readers at the end of first grade (oral reading fluency approximately 13 words per minute on first-grade text), despite advancing significantly beyond children who did not receive those layers ($M WJ = 86.4$ and 78.3 , re-

spectively, for children with and without disabilities in Layer 4).

Because we followed the children for 2 years, we also observed some children moving in and out of the high-risk classification. We treated children from the high-risk group with age-appropriate literacy tasks (e.g., letters and phonemic awareness in kindergarten; phonemic decoding, word reading, spelling, and reading fluency in first grade) and removed them from the high-risk group when their standard scores on the WJ rose above 85. The problem with this criterion is that it may not be sufficiently rigorous on foundation skills when schools include a high proportion of high-risk children. A child may reach a benchmark on an early reading skill and still progress slowly in the more difficult skills attained later by average readers. For example, three children removed from the risk category at the end of kindergarten reentered the risk group in first grade.

Children With Disabilities

Children with high-incidence disabilities were identified gradually over the course of these layers of intervention. Of the 14 children in the original sample eligible for special education services by the middle of second grade, all were included in the high-risk group identified in October of kindergarten. Five children with disabilities (4 with LD and 1 with MMR) were among those who responded well to whole-class phonological instruction in kindergarten, although they still needed additional support to maintain or catch up in reading in first grade. In Layer 2, 5 of the strong responders and 4 of the weak responders were children later identified for special services. For the children with disabilities, attaining threshold levels of phonological segmentation and letter naming was useful but insufficient to ensure adequate reading progress across the 2 years of this study.

Overall, 70% of the children with disabilities responded well to these specialized treatments, although most still did not “catch up” in reading, as defined by average performance on the WJ. Of the 10 students with disabilities who received all layers of intervention, only 4 were reading in the average range at the end of Grade 1. The slow reading progress of children with disabilities in between particular layers suggests that they will still need additional support in second grade for acceptable literacy progress to continue.

Limitations

Although code instruction was part of the general class reading approach in first grade, none of the teachers labeled their program as a code-emphasis approach, and

our observations corroborate their view. Given the studies reported by Torgesen (this issue/2000), it seems possible that the outcomes of these layers may have been enhanced if whole-class reading instruction in Grade 1 had a heavier emphasis on phonetic decoding. Also, we only have information on children with disabilities through second grade, and more children may be identified with the higher reading demands of third and fourth grades.

In this school district—as nationally—most students with high-incidence disabilities are identified for special education in second through fourth grade, and so specialized reading instruction in the early grades is often unavailable. Given the relatively low intensity of each layer (i.e., 12 to 30 min of targeted support three or four times per week), we were encouraged by the proportion of response and also realized that the intensity was insufficient for some children and that low-cost resources can be difficult to marshal in schools. Although teachers and parents were willing to offer or accept a stronger early literacy emphasis in kindergarten, many were unwilling to single out children for specialized treatment, even when low skills placed those children at risk for reading problems. Across the layers of intervention, we were unable to offer additional support to 33% to 45% of the children at risk (although two of these children received special education midway through first grade).

Predicting Children Who Responded Poorly

Following each layer of intervention, we examined the progress of children to consider whether we could have predicted which children would respond well or poorly and which children would need continued assistance. Although, as a group, strong responders began with higher scores, all of the children in increased-intensity conditions began with very poor literacy skills—thus, entry skill level was not a good predictor of future response to treatment. A look at October of kindergarten scores (see Table 2) suggests that blending ability may have been lower for weak than for strong responders; however, some children with blending scores of zero in October made good gains across the year with just Layer 1 intervention.

Ethnicity was not a good predictor, either. The proportion of weak responders of each ethnicity mirrored those proportions in the general sample. Disability status also was not a helpful predictor, because most children with disabilities were not identified as early as first grade; in hindsight, clearly, a higher proportion of children with disabilities struggled with reading acquisition than did children without disabilities. Some children with disabilities made strong gains in blending, segmenting, letter knowledge, and spelling; some children

with disabilities who received only Layer 1 also improved remarkably in these skills.

Ten of the 12 most resistant learners (children who consistently either responded poorly or lost ground between specialized support) were eventually identified for special education; we were surprised that the other 2 were not. We were only able to bring about 40% of children with disabilities into the range of average performance (as defined by reading standard scores of 86 or higher at the end of Grade 1). Among children at risk at the beginning of kindergarten who received only an enriched kindergarten experience (Layer 1), 25% achieved average reading performance 2 years later. Of 27 children still at risk at the end of kindergarten ($WJ < 86$), only 2 achieved average literacy without additional layers of support.

The most important implication of this work may be the effort necessary to maintain nearly normal progress for the children with initial difficulty in reading.

CONCLUSION

Using Torgesen's (this issue/2000) method of calculating weak responders, the 44 children at risk midway through kindergarten constitute the bottom 30% of the sample. We only secured permission for 34 of those children to participate in additional interventions across the 2 years, and, of those children, 8 (24%) scored more than .5 standard deviation below the mean on the combined Word Attack and Word Identification subtests. Multiplying .30 by .24 yields about 7% with sustained reading problems despite participating in all offered layers of intervention. Although this figure is somewhat higher than those in the other studies summarized in this article, we included children with disabilities and children with low verbal ability (i.e., 16% of our total sample had scores lower than 75 on the revised Peabody Picture Vocabulary Test; Dunn & Dunn, 1981).

Implications

These schools had a history of poor literacy performance. In the 1st year of this study, 40% of first graders fell in the bottom quartile of reading scores on the May administration of the Iowa Test of Basic Skills (ITBS). Targeted interventions with kindergarten–first-grade children decreased the proportion of first-grade readers in the bottom quartile of the ITBS in the participating schools to 16% near the end of Layer 4. Fewer children in these schools were identified for remedial services in

second grade (from 36% of second graders to 17% in the year following this project).

Despite these improvements, the proportion of children identified for special education (11% by the end of second grade) did not change. At the end of first grade, seven students with disabilities fell 1 or more standard deviations below the mean on the WJ subtests (range = 74–85), even though they participated in all layers. Four students with disabilities who performed in the normal range of the standardized measure (WJ scores of 87–101) still sustained poor oral reading fluency (7–15 wpm on first-grade text). By the middle of second grade, these students were clearly reading below the level of their peers. We were unable to “fix” their reading acquisition struggles or their eligibility under the reading disabled category with these layers of intervention.

The most important implication of this work may be the effort necessary to maintain nearly normal progress for the children with initial difficulty in reading. The proportion of children at risk at the end of kindergarten who “caught up” in first grade without specialized instruction was about 1%. Even when interventions succeeded in teaching the skills that were the focus of that layer, many of the strong responders did not attain “the rich get richer” side of the Matthew Effects equation (Stanovich, 1986). Within just a few months, most of the children with disabilities and several others lost ground in comparison with the children not at risk when reading instruction retreated to the status quo. These findings are sobering because we may be seriously overestimating the effects of our short-term interventions on the long-term trajectory of reading growth.

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