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Tiers of Intervention in Kindergarten Through Third Grade

Rollanda E. O'Connor, Deborah Fulmer, Kristin Harty
University of Pittsburgh

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Abstract

The goal of this study was to describe and measure the effects of continuous, as-needed intervention in reading for 92 children in Grades K-3 to determine whether the severity of reading disability (RD) could be significantly reduced in the catchment schools. Tier 1 consisted of professional development for teachers of reading that focused on findings from the National Reading Panel Report of the Subgroups (2000). Additional instruction was provided as early as kindergarten for children whose achievement fell below average. Tier 2 intervention consisted of small group reading instruction 3 times per week, and Tier 3 was daily instruction delivered individually or in groups of 2. Participating second and third grade teachers formed their own control, because their children were measured in the first and second years of the study, before their grade was included, and also in the following year, when their children were full participants in the treatment. A comparison of the reading achievement of third grade children showed significant differences favoring children in the treated years in decoding, word identification, fluency, and reading comprehension.

By the late 1980's reading researchers were aware of the associations between phoneme awareness (i.e., the ability to hear and manipulate the sounds in spoken words) and reading ability, whether measured concurrently or used to predict reading achievement one or more years later (Juel, 1988; Perfetti, Beck, Bell, & Hughes, 1988; Share, Jorm et al., 1984). Because this relationship was stronger than those between reading and child characteristics that were known to be difficult to change, such as IQ or socioeconomic status, researchers experimented with instructional studies in which children were taught to blend or segment spoken words and the impact on reading development was assessed (Ball & Blachman, 1991; Bus & Ijzendoorn, 1999; O'Connor, Jenkins, & Slocum, 1995; Torgesen, Morgan, & Davis, 1992). The collection of experiments suggested that phoneme awareness could be taught to children who did not acquire it naturally, and that doing so generated small but reliable effects on reading words.

Researchers began to consider whether early intervention that focused on phoneme awareness and letter knowledge might decrease the incidence or severity of RD (O'Connor, 2000; Torgesen, 2000), however, two problems soon became apparent. First, the children who might benefit from early intervention needed to be identified in kindergarten or first grade, much earlier than is common within systems of special education. The prediction efforts that used measures of phoneme awareness in kindergarten to identify children who might develop reading disability (RD; Good, Simmons, & Kame'enui, 2001; O'Connor & Jenkins, 1999; Wagner et al., 1997) netted a much larger percentage of children than the incidence of RD, often two to three times as many children as will actually struggle with learning to read. This overprediction occurs in virtually all prediction efforts, and so ad-

vocates of early intervention suggest that the intervention that occurs as a result of the prediction should be flexible, so that children who are incorrectly selected can be released from the prediction net (Jenkins & O'Connor, 2002). Second, although early intervention in reading is often successful, it can also be costly. In many of the studies, instruction has been delivered in small groups or through individual tutoring, which can be difficult to manage in general education environments.

Resolving these problems suggests a model of intervention in which general class teachers become the first layer of an intervention effort. By the late 1990's, we (along with other research teams) began experimenting with models of intervention that incorporated frequent measurement of children's reading progress with improvements in classroom teaching brought about by ongoing professional development for teachers in kindergarten and First Grade (Blachman et al., 1999; O'Connor, 2000; O'Connor, Notari-Syverson, & Vadasy, 1996). The combination of professional development and direct intervention with children appeared to reduce the proportion of poor readers in our sample (O'Connor, 2000), however, we were also aware that the 40% identified as at risk in kindergarten included substantial overprediction of reading problems, and that the 12% who remained poor readers at the end of First Grade could increase as reading becomes more complex.

To obtain a more accurate estimate of the effects of early intervention on RD, it would be important to follow students' reading progress and perhaps to continue intervention efforts beyond First Grade. The current study, funded by the Office of Special Education Projects, began in 1999. We used historical control groups of second and third graders in 2 schools to ease the confound of teachers effects, and tested the additive effects of ongoing professional devel-

opment for teachers and direct intervention with children on children's reading development and placement in special education over their first four years of schooling—Grades K-3.

Method

Participants

The principals of two low and middle income urban schools and all general (n=16), remedial (n = 2), and special education teachers (n = 2) agreed to participate. The cohorts of children began with just over 100 children per grade in each condition (Control, Tier 1, Tiers 2 and 3), with about 12% attrition over the four years. Less than 2% of children in these schools were English language learners.

School 1 is located in an industrial area of a city in the NE that draws from very low SES and middle income communities. Fewer than 10% of the parents report any college education. Ethnicity statistics are 12% African American, 7% Hispanic, 9% Native American, and 72% Caucasian. This school employs two full-time special educators who work primarily with children who have learning disability (LD), mild mental retardation (MR), and emotional disturbance (SED), along with two full-time Title 1 teachers who assist children in inclusive classes, as well as provide pull-out small group reading instruction. From 1998-2000, 15% of the school population received special education services.

School 2 is a university affiliated laboratory school located in an urban environment. Many of the children's parents are highly educated and most pay tuition for their children to attend, although 12% are supported through tuition aid. The ethnicity statistics are 15% African American, 57% Caucasian, and 28% Other. In 2000, a remedial reading specialist provided services in reading to 18% of children in the primary grades.

Tier 1: Professional Development

During the first three years, teachers in participating grades, teaching assistants, and principals participated annually in three full-day (September, November, and March) and four 2-hour professional development sessions (October, December, February, and May) about research-based strategies for promoting reading acquisition.

The first year included only staff who worked with children in Grades K-1. An additional grade was added each year (i.e., K-2 in Year 2, K-3 in Year 3). The content of these sessions shifted across years as teachers of students in later grades were added to the intervention participants. Each session began with the research evidence for emphasizing particular components of reading and continued with models of activities for teaching each component (e.g., phonemic awareness, phonics, and vocabulary in K-1; the alphabetic principle, vocabulary, word study and fluency in Grades 1-2; multisyllabic word approaches and comprehension strategies in Grades 2-3). Teachers met in grade level groups across schools to discuss activities, instructional changes, and timelines for implementation. Although we taught teachers to use specific strategies and instructional activities (e.g., segmenting, group responding, word analysis, main idea generation), teachers continued to use the same background reading materials throughout the four years of the study.

Professional development (PD) also included information on assessment of reading progress and how to interpret assessment results for students on these measures. Teachers received printouts of their class roster with each child's scores across each measure over time. The researchers suggested benchmarks for average performance, and teachers tried to match instructional activities to their students' needs as suggested by the measures. In the weeks between in-service, we dropped in on teachers' class-

rooms to provide feedback and instructional support for making modifications. These short sessions allowed unstructured time for questions, feedback, and discussion of children's progress.

Tier 2: Small Group Instruction, 3 Days per Week

Measures collected three times each year (and more frequently for high-risk children) allowed us to determine children's responses to the least invasive layer of treatment—increases in the amount of research-based reading instruction implemented by their teachers. Because measures administered early in kindergarten tend to overselect children as “at risk,” we did not begin additional tiers of intervention until after we had administered the January measures. We considered the children who named fewer than 15 letters or 10 phonemes to be at risk (e.g., Good et al., 2001; O'Connor & Jenkins, 1999), and so 31 children received Tier 2 in kindergarten. Research personnel provided instruction to these children in small groups of 2 to 4 students for 10-15 minutes 3 times per week. Instructors used smaller instructional sets and easier levels of tasks and provided more repetition to develop key concepts. By the end of the year, 9 children had caught up and stayed in the average band over the next 3 years. Two more children appeared to have caught up, but needed additional small group instruction midway through Grade 1. None of these 11 children was later diagnosed with RD.

In First Grade the following year, we provided small group instruction for 20-25

minutes three times per week to 18 children who met the at risk criteria during the September testing (i.e., less than 15 phonemes correctly segmented or 35 letters identified; At later measurement points we used standardized scores on the WRMT of < 92 or fluency rates less than the benchmarks reported in Good et al., 2001). Figure 1 shows the Tier 2 and 3 assistance provided to children from mid-kindergarten through the end of Grade 3. In first grade we used cumulative introduction to teach short vowel sounds, and supplemented classroom materials with sentences composed of decodable words. As children learned most of the letter sounds, we drew upon more meaningful reading materials with primarily decodable text, such as the Bob Books (Maslen & Maslen, 1998), storybooks from Reading Mastery I (Engelmann & Bruner, 1995), and decodable mini-books from Open Court (SRA/McGraw-Hill, 1998) to provide practice reading running text. Teaching in small groups provided many more opportunities for children to respond, to read aloud, and to receive feedback during instruction. By January, 2 of these 18 achieved average reading performance and maintained it through the end of third grade. Two additional children had demonstrated no difficulty at the end of kindergarten or beginning of first grade (i.e., their segmenting and letter knowledge developed along a typical trajectory), but were folded into Tier 2 as they developed problems related to reading words and improving fluency. By Grade 3, neither child needed additional assistance.

Figure 1. Movement among Tiers from mid-kindergarten through the end of Grade 3.

The top row represents measures over time, from K-2 (mid kindergarten) through 3-3 (end of Grade 3). Each following row represents a child who was selected in January of kindergarten as at risk for reading difficulties. An X at a time point means that scores on the measurements fell within the normal range.

Time, from Mid-kindergarten (k-2) Through the End of Grade 3 (3-3)											
K-2	K-3	1-1	1-2	1-3	2-1	2-2	2-3	3-1	3-2	3-3	
Tier 2	X	X	X	X	X	X	X	X	X	X	
Tier 2	X	X	X	X	X	X	X	X	X	X	
Tier 2	X	X	X	X	X	X	X	X	X	X	
Tier 2	X	X	X	X	X	X	X	X	X	X	
Tier 2	X	X	X	X	X	X	X	X	X	X	
Tier 2	X	X	X	X	X	X	X	X	X	X	
Tier 2	X	X	X	X	X	X	X	X	X	X	
Tier 2	X	X	X	X	X	X	X	X	X	X	
Tier 2	X	X	X	X	X	X	X	X	X	X	
Tier 2	X	X	X	X	X	X	X	X	X	X	
Tier 2	Tier 2	X	X	X	X	X	X	X	X	X	
Tier 2			X	X	X	X	X	X	X	X	
X	X	X	Tier 2		X	X	X	X	X	X	
X	X	X	Tier 2					X	X	X	
Tier 2					X	X	X	X	X	X	
Tier 2			X	X	X	Tier 2	X	X	X	X	
Tier 2			X	X	X	Tier 2	X	X	X	X	
Tier 2			Tier 3			Tier 2	X	X	X	X	
Tier 2			Tier 3				X	X	X	X	
Tier 2			Tier 3				X	X	X	X	
Tier 2	X	X	X	Tier 2	X	Tier 2	X	X	X	X	
Tier 2	X	Tier 2		X	X	Tier 2		X	X	X	
Tier 2			Tier 3		Tier 2			X	X	X	
Tier 2			X	Tier 2		X	X	Tier 2		X	
Tier 2			Tier 2					X	Tier 2		X
Tier 2	X	X	X	Tier 3			X	Tier 2		Tier 3	
Tier 2			Tier 3			X	Tier 2		Tier 3		
Tier 2	X	X	Tier 2		Tier 3						
Tier 2				Tier 3							
Tier 2			Tier 3								
Tier 2			Tier 3								
Tier 2			Tier 3								

By mid to late First Grade, 10 children who made poor progress were shifted to Tier 3 intervention (description follows), but we continued small group, Tier 2 intervention in 20-30 minute sessions three times per week for nine 2nd graders. Three of these students continued Tier 2 as 3rd graders. Some children in small groups spent roughly half of the time on word patterns, decoding, and spelling, followed by reading aloud in text containing those patterns. Other groups of children had skills near grade level, but very slow reading rates. These children spent most of their small group time reading and rereading text to build fluency and comprehension.

Our Tier 2 instruction shared similarities with Vaughn's Tier model by being based on ongoing measurement of children's progress, conducted in small groups of 3 or 4, delivered in addition to general class instruction, and led by research personnel. It differed in two ways. First, instruction in Tier 2 targeted specific areas of weakness observed through our measurement system, rather than offering a complete reading lesson. Because of this feature, the content of Tier 2 differed for various small groups of children. Second, the duration of Tier 2 varied from 8 weeks to several years, depending on the students' progress. We measured the core skills monthly and as children's progress improved, dropped them from Tier 2 assistance or folded them back into an appropriate Tier 2 group.

Tier 3: Daily Small Group or Individual Instruction

Of the children who continued to receive Tier 2 past kindergarten, over half were in the average range on reading measures by the end of second grade and needed no assistance to stay in the average band through third grade. Tier 3 in this study consisted of individual or group of 2 instruction 5 days per week conducted by a member of the research team. Tier 3 began in January of First Grade for 8 children, and all but 3 of the children who became eligible for special services as LD were in Tier 3 at that time. Two more students later identified as LD were placed in Tier 3 at the end of First Grade, but so were 4 others, who became average readers by third grade. Some children in our study made poor progress in whole class and supplemental skill instruction, but caught up well when instruction was more intense (daily, focused, and often 1:1). Nearly 40% of children who received Tier 3 progressed sufficiently to maintain average performance throughout third grade without additional interventions.

Results

Student Outcomes

The layered design of data collection allowed us to compare the children with disabilities in the control group (same schools prior to intervention) at the end of third grade with the effect of a 3-tiered approach to intervention on the incidence and severity of RD. Descriptive statistics for the children identified as at risk and those identified with RD are shown in Table 1.

Table 1. Third Grade Outcomes for Children Identified as At Risk** in kindergarten

	With Disabilities		Without Disabilities
	Control (n = 15)	RD in Tiers 2 or 3 (n = 7)	Tiers 2 or 3 (n = 15)
Word Identification	86.4 (5.4)	89.5 (9.4)	101.1 (6.6)
Word Attack	83.6 (7.5)	99.3 (10.1)	107.1 (7.6)
Comprehension	81.5 (8.2)	93.8 (14.5)	104.6 (13.1)
Fluency	34.2 (16.7)	65.1 (25.7)	111.3 (28.2)
PPVT-R	95.3 (15.1)	93.9 (9.6)	105.3 (15.2)

** Although 31 children were identified in kindergarten, the 9 kindergartners who received no additional assistance after kindergarten are not included here, as they were probably false positives in the selection process.

Student outcomes overall at the end of Grades 2 and 3. Professional development alone (Tier 1) improved reading outcomes significantly over the Control for Word Attack, Comprehension and Fluency in Grade 3 ($F(2, 283) = 16.24, 9.97, 36.96, p < .01$). Scores on receptive language (PPVT-R) did not differ. By the end of third grade, effect sizes (Cohen's d) for professional development (Tier 1) over the Control for Word Identification, Word Attack, Reading Comprehension, and Fluency were .19, .34, .29, and .52, respectively.

Outcomes for students with disabilities. Descriptive statistics for children with and without disabilities who received Tiers 2 or 3 are shown in Table 1, along with children with disabilities in the Control from two years earlier. All of the children in Tiers 2-3 received additional direct intervention at some point during the K-3 years, and 9 students received it for all 4 years. As with the

larger sample, direct early intervention (Tiers 2 and 3) for children with disabilities showed moderate to large effect sizes (Cohen's d) over the Control at the end of Grade 3 (.40, 1.8, 1.0, and 1.4, respectively, for Word Identification, Word Attack, Passage Comprehension, and Fluency). It is tempting to speculate on the stronger outcomes for children at risk who received Tiers 2 and or 3, but were not identified for special education. Would some of these children have been identified if early intervention had not been delivered? Given the small sample (about 100 children per grade), such speculation is premature.

Placement in Special Education

In the historical control group (same schools and teachers), the incidence of placement in special education averaged 15%. Following four years of participation in this research, the rate of placement was 12% in the professional development condition (Tier 1) and 8% in

professional development plus direct intervention (Tiers 2-3). Across conditions, 1- 2% of students were eligible under the category of mental retardation, and the remainder under the category of learning disability (LD).

At the beginning and middle of second grade, we found considerable overlap in scores on the subtests of the WRMT-R between children who were later identified for special education and those who were not. May of Grade 2 was the first time point at which those eventually diagnosed with RD scored distinctly differently from others who struggled with reading acquisition. This difference was clear on the measures of oral reading fluency and comprehension, however we still found overlap on word attack and word identification into third grade.

Discussion

Children were selected for more intensive intervention if they fell below the cut-off scores on the phonological measures (O'Connor & Jenkins, 1999), WRMT-R, or oral reading fluency (Good et al., 2001) that have successfully identified children with reading disability profiles in these grades. Although data were collected by university personnel, teachers ultimately had control over how the data were used. For example, teachers determined whether students would receive Tier 2 as in-class or pull-out services. As teachers learned new ways to group for reading and to provide appropriate practice, some teachers were able to orchestrate these opportunities without pullout assistance from project personnel, although about 80% of Tier 2 and all of Tier 3 were provided by the research team. Thus, opportunity for children to receive targeted intervention prior to becoming eligible for special education interfaced

with teachers' use of performance data.

Tiers 2 and 3 were not "one size fits all" interventions. The small group activities were tailored to the needs of the two, three, or four children in the group. As needs changed, groups were rearranged. Some groups focused on strategies for reading words children encounter in print and do not immediately know. Instruction in these groups included phonic generalizations (e.g., an 'e' on the end of a word often signals a long vowel) and orthographic patterns (e.g., -ain makes the same sound in rain, stain, and terrain) that commonly occur in written English (Gough & Walsh, 1991; Moats, 2000). Several groups in Grades 2 and 3 included comprehension strategies as part of their intervention, however, we found no children in either school with grade appropriate decoding and fluency, but poor comprehension.

Nine children identified as at risk in kindergarten caught up sufficiently in that year to need no additional intervention. Four of the 18 first graders who continued with Tier 2 intervention improved to the average range by the beginning of second grade. By third grade, only 9 of the 31 children identified in kindergarten continued to need interventions in addition to general class instruction. Of the children who received Tiers 2-3 for all four years, 7 became eligible for special education, two identified as first graders, 3 in Grade 2, and 2 in Grade 3.

Using Tiers of Intervention to Identify LD

The data in our study do not show identification as cleanly as those in Vaughn's work. Although all of the children eventually identified with LD were among the broad net we cast in kindergarten, we found more "in and out" movement, in which children ap-

peared to be at risk at some time points, reached the average range (with Tier 2 or 3 interventions) for short periods of time, and then fell behind again when supports were removed and/or reading tasks became more difficult. Figure 1 demonstrates this messiness.

If we compare descriptive statistics for the children who were identified as LD with those at risk who became average readers, we see no differences in kindergarten scores, and only small trends at the end of first grade (e.g., about 2 raw score points on each subtest of the WRMT). Dot plots show considerable overlap among groups for these scores and also for oral reading fluency, although we also found a group of students who had participated in Tier 2 whose oral reading at the end of first grade exceeded 40 words per minute (the benchmark in the work of Good and colleagues), and these students needed no additional assistance through third grade. In our data, it was not until the end of second grade that the scores of the two groups (those with and without LD) became clearly differentiated, and even then, only in fluency and comprehension.

Achieving levels of fluency sufficient for the development of reading comprehension is clearly a stumbling block for students with RD, even as discrete skills, such as decoding words, improve. We saw changes between control and treatment years in the amount of time teachers in general classes devoted to fluency practice, particularly in the second grades. Although this increase in emphasis improved outcomes for the second graders overall, it was still not enough to eliminate the fluency bottleneck for the children with disabilities. Among the control group, for example, 23 of the 101 second graders read fewer

than 50 words per minute in grade level text, a rate associated with reading failure by some researchers (e.g., Good et al., 2001). Children who participated in the tiered interventions fared better, however 9 children still read fewer than 50 words per minute at the end of 2nd grade. By the end of 3rd grade, 5 children in Tier 3 read fewer than 66 wpm, despite four years of intervention.

Our sample was small, however, our measurement system allowed us to track changes and growth spurts over time. We noticed a trend in the data between first and second grades and second and third that suggested that children eventually identified for special services tended to drop in reading scores over the summer months, while those without disabilities—even those at risk students who received Tiers 2 and 3—tended to grow. Future studies could be designed to explore this trend with larger samples, and to determine whether summer growth and decline might be another avenue for early identification and intervention in RD.

Rates of placement in special education. By assessing the effects and outcomes of each stage of intervention, we hoped that a decreased referral rate to special education would occur. Although the rates of placement in special education appeared to decrease, rates are not necessarily consistent in a school from one year to the next, therefore, we are not confident that this decrease is a result of the early intervention provided through this project.

We were encouraged with the reading progress of children with LD, however, children reading near the average range were still referred to special education during second or third grade. One possible reason for these “nearly normal” referrals was the discrepancy be-

tween the reading performance of children eventually labeled with disabilities, and the average reading achievement of children in their classrooms. When we examined the spread of scores during the treatment and control years, this possibility warranted attention. Although scores of the top 25% of students across years appear to be about the same, the scores of “average” children rose about a half standard deviation. Children diagnosed with reading disability had composite standard scores around 93, versus classmates with standard scores averaging 112. Thus, children diagnosed as RD were approximately 1.3 SD’s below the mean of their peers, which is about the same difference between children with and without RD in the Control group.

A model of tiered interventions ap-

pears to help children who struggle with reading acquisition, and could help to document alternative instruction before a student is referred for special education services. By first teaching children in whole group lessons, then intervening in smaller groups, and then--only when necessary--with pullout instruction, we implemented a technique feasible in general and special education settings. By second and third grade, however, it became clear to us that the instruction in general education classrooms might not be a good match for the needs of children who had failed to thrive in Tier 2. The increasing difficulty of words and the expanding range of text in these grades made word study and fluency practice at appropriate levels difficult for general class teachers to manage.

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