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Indexing Response to Intervention

A Longitudinal Study of Reading Risk From Kindergarten Through Third Grade

Deborah C. Simmons
Texas A&M University
Michael D. Coyne
University of Connecticut
Oi-man Kwok
Texas A&M University
Sarah McDonagh
Charles Sturt University
Beth A. Harn
Edward J. Kame'enui
University of Oregon

In this study, response to intervention and stability of reading performance of 41 kindergarten children identified as at risk of reading difficulty were evaluated from kindergarten through third grade. All students were assessed in the fall of each academic year to evaluate need for intervention, and students who fell below the 30th percentile on criterion measures received small-group supplemental intervention. Measures included a combination of commercial normative referenced measures and specific skill and construct measures to assess growth or change in reading risk status relative to 30th percentile benchmarks. Results indicated that consistent with the findings of prior research involving students with comparable entry-level performance, the majority of children identified as at risk in the beginning of kindergarten responded early and positively to intervention. On average, absolute performance levels at the end of kindergarten positioned students for trajectories of later reading performance that exceeded the 50th percentile on the majority of measures. Moreover, changes in risk status that occurred early were generally sustained over time. Only oral reading fluency performance failed to exceed the 30th percentile for the majority of students.

Keywords: *response to intervention; early reading intervention; longitudinal reading research*

In a seminal descriptive study of reading achievement, Juel (1988) chronicled the developmental continuity of poor reading performance across the primary grades. Specifically, 21 of 24 students who performed in the bottom quartile on the Reading Comprehension subtest of the *Iowa Test of Basic Skills* (Hieronymous, Lindquist, & Hoover, 1980) at the end of first grade demonstrated significantly below-grade-level reading comprehension at the end of fourth grade. Although this classic study was conducted decades before the term *response to intervention* (RTI) entered the research and practice terminology and literature, Juel documented a problem and proposed an instructional solution for children who do not benefit adequately from typical classroom reading instruction. First is the problem. In Juel's study, few children who exited first grade with limited proficiency in prerequisite skills of phonemic awareness and decoding developed timely proficiency in more complex reading skills, including reading comprehension. For the majority of these children, reading risk on phonemic awareness and

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decoding emerged early, and low reading performance remained generally constant from first through fourth grade. Regarding the solution, Juel conjectured that the end of first grade may be too late to effect meaningful change in reading performance and, consequently, encouraged exploration of earlier intervention.

During the past 15 years, the continuity or stability of reading trajectories has been examined in multiple descriptive studies, and findings have reliably supported Juel's (1988) primary conclusion: With typical instruction, children identified as at risk of reading difficulties have minimal odds of overcoming these risks. Smith (cited in Phillips, Norris, Osmond, & Maynard, 2002) found that 71% of children with the lowest preschool assessment scores read below grade level at the end of third grade, whereas 93% of preschool children who performed above grade level maintained above average performance 5 years later. Francis, Shaywitz, Stuebing, Shaywitz, and Fletcher (1996) corroborated the stability of reading achievement with their finding that 74% of third graders with identified reading disabilities remained reading disabled in ninth grade. In perhaps the most hopeful of nonintervention, longitudinal studies, Phillips et al.'s (2002) study of 187 boys and girls from first through sixth grade in eastern Canada found relative reading achievement more "porous" (p. 10) than other studies. In their study, 50% of students who performed below average on the *Gates-MacGinitie Reading Test* (MacGinitie et al., 1978) in May of first grade performed in the average range at the end of sixth grade. Although measures, locale, student demographics, and instruction may account for variation in the proportion of students who attained average levels of reading achievement, contemporary longitudinal descriptive studies confirm that, at best, the odds of becoming an average reader in the later elementary grades if you are a poor reader in the early primary grades is no better than 50–50 without intervention and, in fact, may be significantly worse.

A Response to Evidence of Reading Alterability

In contrast to longitudinal descriptive studies, a decade of intervention research on early reading difficulties provides evidence that poor reading performance is not only modifiable but in many cases preventable (Foorman, Breier, & Fletcher, 2003; Schatschneider, Fletcher, Francis, Carlson, & Foorman, 2004). Based on promising evidence from this body of research, RTI has emerged as an instructional alternative to traditional remedial and special education services (Dickman, 2006). Central to this approach is the assumption that for many students, reading achievement is alterable through timely, progressively more intensive instruction that relies on research-based instruction and formative assessment (Coleman, Buysse, & Neitzel, 2006; Denton, Fletcher, Anthony, & Francis, 2006; National Joint Committee on Learning Disabilities, 2005).

The RTI initiative was influenced by a range of empirical sources, including research highlighting the criticality of establishing specific early reading skills (Juel, 1988; National Reading Panel, 2000) and intervention research documenting the difficulty of normalizing reading achievement beyond the early grades (Lovett, Lacerenza, & Borden, 2000; Torgesen et al., 2001). Multiple researchers have examined the alterability of low reading performance by focusing on prevention and early intervention (Foorman et al., 2003; Simmons, Kame'enui, Stoolmiller, Coyne, & Harn, 2003; Vadasy, Sanders, & Peyton, 2006). In contrast to longitudinal studies that document and describe the stable state of reading achievement over time, contemporary intervention research verifies that poor reading performance is not incontrovertible. In fact, growing research evidence supports the efficacy of prevention and intervention efforts with young children identified as at risk for reading difficulties (Cavanaugh, Kim, Wanzek, & Vaughn, 2004; Foorman, Francis, Fletcher, Schatschneider, & Mehta, 1998; O'Connor, Fulmer, Harty, & Bell, 2005; Scanlon, Vellutino, Small, Fanuele, & Sweeney, 2005; Torgesen, 2000; Vellutino et al., 1996).

An underlying assumption of RTI is that there is a window of opportunity wherein reading difficulty is more easily altered by instruction and risk of later reading difficulty is likewise minimized (Lyon & Chhabra, 1996). For example, emerging evidence suggests a differential and positive benefit of intervention that begins prior to first grade (Scanlon et al., 2005; Vadasy et al., 2006). A preventive RTI model assumes that students at risk should (a) be identified early with reliable and valid indicators of reading difficulties (Schatschneider et al., 2004), (b) receive instruction that is informed by a reliable and scientific knowledge base regarding the essential elements of reading (National Reading Panel, 2000; Vaughn & Fuchs, 2003), (c) receive the quantity and quality of instruction necessary to attain adequate levels of proficiency on important outcomes (Foorman & Torgesen, 2001; Torgesen et al., 2001; Vellutino et al., 1996), (d) reach levels of established reading proficiency on critical goals by critical benchmark periods (Good, Simmons, & Kame'enui, 2001), and (e) maintain adequate levels of reading proficiency during postintervention periods. During the past several years, researchers have conducted

studies to address these critical attributes of RTI. Below, we briefly review relevant longitudinal research and clarify the purpose and importance of the present study to this emerging body of research.

Prior Longitudinal Intervention Research Initiated in Kindergarten

Kindergarten has emerged as an instructional period wherein foundational early literacy skills have been found to be predictive of later reading achievement (Cavanaugh et al., 2004; O'Connor, 2000; O'Connor et al., 2005; Scanlon et al., 2005; Torgesen et al., 1999). As important, there is evidence to suggest that these early literacy skills may be jumpstarted so as to better position students for subsequent reading success.

Vellutino et al. (1996) speculated that children whose phonological coding difficulties were not satisfactorily mediated by first-grade intervention might have profited from instruction in foundational skills that began in kindergarten. To empirically evaluate their hypothesis, Scanlon and colleagues (2005) identified 430 kindergarten children who performed below the 30th percentile on the Letter Identification subtest of the *Woodcock Reading Mastery Tests–Revised* (WRMT-R; Woodcock, 1987) and randomly assigned them to either an intervention condition (2-day per week, small-group instruction focusing on phonemic, alphabetic, and orthographic skills) or to a typical practice comparison condition. Students in the comparison condition received school-designed intervention, some of which involved extra instruction on literacy skills. Returning participants in the treatment condition continued in first-grade interventions if their composite scores on the Letter Identification, Word Identification, and Word Attack subtests were at or below the midpoint of the distribution of composite scores for children who participated in the kindergarten intervention. By design, 50% of treatment children who received the kindergarten intervention received first-grade intervention. In addition, there were intervention conditions in first grade for students who served in kindergarten comparison conditions. Fall standard scores of first-grade treatment children who continued intervention were 88.67 on Word Identification WRMT-R and 77.39 on Word Attack WRMT-R. Findings at the beginning of first grade indicated that 51% (80/161) of students who received kindergarten intervention were out of risk, compared to 40% (63/158) of students in the comparison condition (it should be noted that criteria for continuation were locally normed). End-of-first-grade results further indicated significant reductions in severe reading difficulties (standard scores below the 15th percentile) for children who participated in the kindergarten intervention, with the incidence of very poor reading reduced to 8%, compared to 25% of children who were in the comparison conditions. Because children who responded to kindergarten intervention did not remain in the study, an index of end-of-first-grade performance maintenance cannot be estimated.

In another longitudinal experimental study, Torgesen et al. (1999) examined the relative effectiveness of three prevention-focused interventions implemented during the second half of kindergarten and extended through second grade. They standardized measures of reading skill to facilitate the interpretation of outcomes and to examine the performance of children who were least responsive to instruction. Children who scored in the bottom 30th percentile on a letter-naming task and who had the lowest combined scores on letter-naming and phonemic elision tasks and scored above 75 on verbal intelligence at pretest were randomly assigned to one of four instructional conditions and were provided intervention for 2.5 years. At the end of intervention, the mean performance of children in the most effective intervention (phonemic awareness plus synthetic phonics) performed in the average range on all reading measures. In a valuable contribution to the study of response to intervention, Torgesen et al.'s disaggregation of findings revealed that 24% and 36% of students in the most effective of instructional conditions performed more than one standard deviation below the mean on Word Attack and Passage Comprehension, compared to 53% and 56% of students in the no-treatment control condition. In sum, kindergarten-initiated and extended intervention substantially reduced the number of children who performed below the 15th percentile on standardized reading measures.

In a similar line of research, O'Connor et al. (2005) conducted an intensive longitudinal study examining the effectiveness of layers of intervention from kindergarten through Grade 3. Noting the difficulties of conducting experimental research in school settings, O'Connor et al. used a historical control design and focused on professional development on scientifically based reading intervention, assessing student progress, and specific intervention intensity required for students who failed to respond to layers of instruction. The criterion for "at-risk" status in October of kindergarten was naming fewer than 15 letters or 10 phonemes on a phonemic segmentation task. In Grades 1 through 3, students who scored 0.75 standard deviations (*SD*) below average on the WRMT-R at any testing window were eligible for intervention. Following the first layer of intervention in kindergarten, 9 of 31 (29%) children who received intervention required

no further intervention over the next 3 years. In Year 2, 17 first graders received intervention, whereas 18 and 9 students received intervention in second and third grades, respectively. Seven students (22% of risk sample) identified in kindergarten received additional intervention beyond general instruction for all 4 years of the study. Compared to students in the control condition, students in intervention groups scored significantly higher on a range of reading measures, with effect sizes in the moderate range. O'Connor et al. noted the "transience of catching up" (p. 452), thereby documenting the need to return to intervention as the reading demands changed or increased. Whereas the kindergarten intervention proved to be a sufficient intervention for almost 30% of students identified as at risk, almost the same percentage of students required intervention across the years through third grade. All students were assessed three times per year and, if they fell below cut scores, were included for further intervention.

More recently, Vadasy et al.'s (2006) randomized field trial found that 18 weeks of paraeducator-delivered code-oriented tutoring produced significantly higher linear growth in at-risk kindergarten children's reading accuracy and efficiency, oral reading fluency, and developmental spelling. The identification period was December; participation criteria included teacher nomination followed by scoring in the at-risk range on two or more *Dynamic Indicators of Basic Early Literacy Skills* (< 27 letter names per minute, < 13 phonemes segmented per minute; DIBELS; Good & Kaminski, 1996). Tutored students maintained benefits throughout first grade with significantly higher end-of-year performance on measures of reading accuracy and reading efficiency.

Purpose of Study

Data from these longitudinal studies corroborate Juel's (1988) hypothesis of more than two decades ago that intervention initiated in kindergarten and focused on phonemic awareness and phonological recoding can position many at-risk kindergarten children for reading success in first grade and beyond, thereby documenting the alterability of early reading risk for the majority of children. In addition, research has documented that the criterion used to identify children at risk, the cut points used to establish "out-of-risk" status, and the measures used in this process vary and, therefore, yield differing response and risk rates. Juel used performance below the 25th percentile on the reading comprehension subtest of the ITBS as the designation of poor reading; O'Connor used .75 *SD* below average on the WRMT-R; Scanlon et al. (2005) used performance below a standard score of 85 (below the 15th percentile) on the WRMT-R basic skills cluster to identify very poor reading performance. Torgesen et al. (1999) used a combination of letter naming and phoneme elision to identify children and reported standardized outcome measures using 1 *SD* below the mean (i.e., < 85) as an index of inadequate response. Finally, Vadasy et al. (2006) used a composite identification process and performance criterion and dual discrepancy approaches to examine response.

In the present study, we addressed the issue of alterability of reading performance among children identified as at risk of reading difficulties using the 30th percentile as both the identification criterion for receiving intervention and the "out-of-risk" performance index. We examined student performance across a 4-year period, from kindergarten through third grade, to determine the probability of attaining and maintaining adequate levels of performance and the variability of risk status over time and across measures. We sought to advance our understanding of the effects of early intervention by focusing on the trajectories of response across a 4-year period of time and standardizing the criteria used to identify risk. To standardize the risk indicator and aid interpretation of results, we selected children in the fall of kindergarten who performed below the 30th percentile on letter-naming fluency based on the DIBELS systemwide database. Participating students, however, also performed in the bottom quartile of their local kindergarten cohort on a measure of phonemic awareness. The use of a single measure to index reading risk, though not without precedence, is a subject of importance. Prior kindergarten intervention studies consistently use letter-naming measures to index reading risk. Specifically, O'Connor et al. (2005) used letter-naming fluency and phonemic segmentation, whereas Scanlon et al. (2005) used a single measure, the Letter Identification subtest of the WRMT-R. Schatschneider et al. (2004) found that "at the beginning of kindergarten, phonological awareness, letter naming speed, and letter knowledge were roughly comparable in their predictive utility, and no variable fully dominated another in predicting word identification skills" (p. 279). Through dominance analyses, however, they did document that letter-naming speed was a better predictor of reading fluency outcomes than letter knowledge and phonological awareness measures. Secondary analyses further examined whether the type of kindergarten intervention (explicitness of code instruction, i.e., high vs. moderate explicitness, and dimensions of instruction, i.e., code vs. code and comprehension) differentially influenced student performance. Our research questions were as follows:

1. What absolute performance levels can children identified as at risk of reading difficulty in fall of kindergarten (< 30% on letter-naming fluency) attain on a range of reading measures?
2. What is the probability that children identified as at risk in kindergarten who receive small-group supplemental intervention will move out of risk (≥ 30th percentile) at intervals from kindergarten through third grade?
3. Are there risk patterns of children that characterize RTI across grades? And is response differentiated by type of reading intervention?

Specifically, the purpose of the study was to examine the alterability and stability of reading performance among 41 children identified as at risk of reading difficulty in kindergarten and to profile patterns of response through third grade. The standardized criterion for risk, < 30th percentile (Torgesen, 2000), was considered a realistic benchmark against which to judge intervention success and achievement on normative and criterion-referenced reading tests. We used a series of progressive measures that parallel the developmental expectations of reading across grades to identify risk. Measures included a combination of commercial normative referenced measures (i.e., WRMT-R) and specific skill and construct measures (e.g., DIBELS Letter Naming Fluency [LNF] and Oral Reading Fluency [ORF]) to assess growth or change in reading risk status relative to 30th percentile benchmarks. For the DIBELS benchmark measures, we used progressive benchmarks and provide percentile correlates drawn from the systemwide percentile ranks at respective grades (Good, Wallin, Simmons, Kame'enui, & Kaminski, 2002).

Method

Participants

In September of their kindergarten year, all kindergarten students ($N = 464$) from seven elementary schools in the Pacific Northwest were screened on the LNF and Initial Sound Fluency (ISF) DIBELS measures (Good & Kaminski, 1996; see description of measures to follow). The study began in fall of kindergarten with 117 students, or 25% identified as at risk. At-risk children were identified according to the following criteria: (a) They scored at or below the 30th percentile on national norms on letter-naming fluency (i.e., less than 6 on LNF) and (b) their performance was confirmed by their kindergarten teachers as being at risk of reading difficulty. In addition, children scored in the bottom quartile of their local kindergarten cohort on ISF. Children were excluded who (a) had severe hearing or visual acuity problems or (b) were determined by school personnel to have significantly limited English proficiency.

All participating schools received Title I funding, and the percentage of students qualifying for free and reduced-cost lunch services ranged from 32% to 63%. In terms of overall enrollment, schools ranged from 319 to 683; total time allocated for kindergarten in all schools was 2.5 hours per day. As a result of the transient nature of the population, 88 at-risk children remained at the end of kindergarten, with incremental attrition across the subsequent 3 years. At the end of first grade, 71 children remained; 60 at the end of second grade; and 41 at the end of third grade with complete data on all measures. We conducted analyses to determine whether there was differential attrition on demographic (e.g., age, gender, ethnicity) and entry-level literacy variables. Results indicated that there were no statistically significant differences between the 41 remaining participants and the original sample.

Analyses were conducted on the cohort of 41 students who participated all 4 years, kindergarten through Grade 3. Sixty-six percent of the sample were male ($n = 27$), 84% were European American ($n = 34$), 14% were Hispanic/Latino ($n = 6$), and 1 student was African American. The fall of kindergarten mean performance level of the 41 students was 2.73 (2.67 *SD*) on LNF.

Intervention Summary

All students were assessed in the fall (September–October) of each academic year to evaluate need for intervention. Over the course of the 4 years, all students who fell below the 30th percentile on criterion measures administered in the fall continued to receive supplemental intervention. Students who met beginning-of-year benchmarks were discontinued from intervention but were assessed in the fall and spring. Intervention entry and continuation decisions were made in the fall. All students who fell below fall cut-scores received intervention. This decision process was followed in all grades except first grade. In Grade 1, student progress was also evaluated in midyear (late January); students who met midyear benchmarks discontinued and those who did not meet benchmarks continued intervention.

Interventions across the 4-year period focused on a developmental sequence of skills and strategies in beginning reading. Initially, the emphasis was on phonemic awareness, phonemic decoding, word reading, and spelling, progressing over time to fluency and text reading interventions. Six of the seven participating schools used the Open Court reading series as their core reading

program; one school used Reading Mastery. Experimental intervention contrasts were conducted each year, and data reported reflect the averages of combined intervention conditions. On average, children received supplemental interventions conducted 30 to 45 minutes, 5 days per week from November through May, in small groups of 3 to 5 students. Interventionists were either certified teachers or highly trained paraprofessionals.

The primary focus of this article was to examine response to kindergarten interventions in general. A secondary emphasis was to examine potential long-term benefit by disaggregating the kindergarten intervention findings. The kindergarten interventions contrasted a highly explicit, code-emphasis intervention (HE-C) with (a) highly explicit code- and comprehension-emphasis (HE-CC) and (b) moderately explicit code-emphasis (ME-C) interventions. All three interventions were 30 minutes daily and were implemented for 21 weeks. The highly explicit code intervention emphasized strategic and systematic instruction of phonemic awareness, alphabetic understanding, letter writing, and spelling and consisted of two 15-minute components delivered consecutively in daily 30-minute lessons. In the first half, instruction established and reinforced the phonological skills of (a) first and last sound isolation, (b) sound blending, and (c) sound segmentation. Furthermore, the intervention emphasized the acquisition and application of fundamental alphabetic skills and strategies of (a) letter-name identification, (b) letter-sound identification, (c) letter-sound blending to read consonant-vowel-consonant (CVC) words, (d) selected irregular word reading, and (e) sentence reading of controlled text. The second 15 minutes reinforced previously taught phonological awareness and alphabetic skills and extended these skills through instruction in handwriting (e.g., letter dictation and formation), integrated phonological and alphabetic tasks, and spelling.

The HE-CC intervention included two 15-minute components. The first 15 minutes included the same lessons as the HE-C intervention and focused on high-priority phonological and alphabetic skills. The second 15 minutes had two primary foci: (a) receptive and expressive knowledge of vocabulary that appeared in storybooks and (b) expanded knowledge and development of story structure and story retell. Critical features included (a) repeated reading of stories, (b) targeted vocabulary selection and instruction, (c) dialog discussion of vocabulary and stories, (d) multiple exposures to target vocabulary, and (e) systematic review and integration of vocabulary words within and between lessons.

The ME-C was dedicated to phonological, alphabetic, and orthographic activities. The explicitness of instruction was considered moderate compared to the HE-C intervention and was based on an existing commercial curriculum. For details on the interventions, see Simmons et al. (2007). Primary findings indicated that the performance of students in the HE-C condition was higher on measures of reading and spelling than that of other conditions and that the HE-C condition was differentially more effective for students who began intervention with the lowest scores.

Criterion and Normative-Referenced Measures Used to Index Risk

The study included measures of letter-naming fluency in kindergarten to establish initial levels of risk. In addition, the *Peabody Picture Vocabulary Test–Revised* (PPVT-R; Dunn & Dunn, 1981) was used as an index of general receptive vocabulary prior to intervention. Throughout the intervention period, measures of (a) phonological awareness, (b) phonemic decoding and word reading, (c) oral reading fluency, and (d) reading comprehension were administered. Because of the developmental nature of reading, not all measures were administered at each measurement point. For this study, measurement periods included (a) the fall of kindergarten (screening) and (b) fall and spring of each academic year, with the exception of Grade 3, for which we administered ORF in the fall and the full complement of measures in the spring. Reliability coefficients for the commercial measures are those reported in the test manuals for children in the age ranges of students in this study. Interrater reliability coefficients for the experimental measures are based on the current study.

Phonological Awareness Measures

Phonemic Segmentation Fluency (PSF) DIBELS measure (Good & Kaminski, 1996). In May of kindergarten, and September of first grade, we individually administered this test of phonological awareness to assess children's ability to produce the individual phonemes in three to four phoneme words presented orally by the examiner. Credit is awarded for each phoneme or segment of the word produced, and the number of correct phonemes produced within 1 minute determines the final score. This fluency-based measure has alternate-form reliability of .88 and predictive validity coefficients ranging from .73 to .91 (Kaminski & Good, 1996).

Phonemic Decoding and Word Reading

Nonsense Word Fluency (NWF) DIBELS measure (Kaminski & Good, 1996). We individually administered this test of letter-sound correspondence to assess

children's ability to blend letters into pseudowords in which letters represent their most common sounds. The student has 1 minute to produce as many letter sounds as possible in consonant-vowel-consonant pseudowords, and the final score is the number of correct letter-sound correspondences produced. Alternate-form reliability for the NWF ranges from .66 to .87, and concurrent validity with the readiness subtests of the *Woodcock-Johnson Psychoeducational Battery* (Woodcock & Johnson, 1989) ranges from .35 to .59. Alternate forms of NWF were administered in spring of kindergarten and fall of first grade to assess growth in alphabetic understanding.

WRMT-R Word Attack subtest (Woodcock, 1987). This individually administered measure assesses a child's ability to read a list of nonwords (e.g., *tet*) presented in isolation. The subtest contains 45 words of increasing difficulty; students earn 1 point for each word read correctly, which is converted into a standard score.

WRMT-R Word Identification subtest (Woodcock, 1987). Consisting of 100 words of increasing difficulty, this test measures a child's skill in reading real words presented in isolation. The raw score is the number of words correctly read. Internal consistency reliability for both subtests of the WRMT-R ranges from .92 to .98 (Woodcock, 1987); no specific reliabilities are reported for kindergarten. Because of potential floor effects on the WRMT-R Word Attack and Word Identification subtests for kindergarten children in the fall, both subtests were administered in spring of kindergarten and in the fall and spring of Grades 1, 2, and 3.

Reading Fluency

ORF is a standardized, individually administered method of assessing reading fluency and overall reading performance. In the fall of first grade, and again in fall and spring of second and third grade, students read two grade-level passages of connected text for 1 minute each; the average of both was used to calculate the number of words read correctly per minute. The ORF score is the total number of words read correctly. Test–retest and alternate-form reliability of ORF measures are consistently above .90, and criterion-related validity is similarly high (L. Fuchs, Fuchs, Hosp, & Jenkins, 2001).

Reading Comprehension

WRMT-R Passage Comprehension subtest (Woodcock, 1987). This silent reading comprehension measure uses a cloze procedure to measure comprehension of text by requiring a student to produce a missing word from a sentence. The child fills in the missing words, relying on what is read in context. The internal consistency of this measure is above .90, and subtests are normed to a mean of 100 and an *SD* of 15. The raw score is the number of words correctly produced, which is converted into a standard score. Data from spring scores were used to evaluate levels of response and performance.

Standard scores on the WRMT-R subtests and the PPVT-R have a mean of 100 and a standard deviation of 15. A score of 92 places a student at the 30th percentile. On the DIBELS measures, the 30th percentile was determined from the systemwide database (Good et al., 2002). Table 1 summarizes measurement points and the 30th percentile scores used to index risk. To illustrate, to qualify for intervention at the beginning of second grade, a student would need to read fewer than 35 correct words per minute. To be "out of risk" at the end of the year, a second grader would need to read 80 or more correct words per minute.

Results

The overall purpose of this study was to examine whether, and to what degree, reading intervention enables children identified in kindergarten as being at risk of reading difficulty to attain adequate levels of reading proficiency. To evaluate the overall impact, we compared the mean performance of children in our sample against that of children in the standardization samples of the WRMT-R and the systemwide sample of the DIBELS database. Table 2 reports the means and standard deviations for the sample of 41 students from kindergarten through third grade for the normative WRMT-R subtests and the benchmark DIBELS measures for periods in which measures were administered. For all measurement points, scores are referenced against the 30th percentile on WRMT-R and DIBELS measures. Therefore, we examined whether student status changed relative to students who performed at the 30th percentile at pretest. Values reflect raw scores for PSF, NWF, and ORF and standard scores for all other measures. Values in the 30th percentile column represent the scores that correspond to the 30th percentile on the particular measure. For example, an end-of-kindergarten PSF raw score of 32 corresponds to the 30th percentile on the systemwide DIBELS database, and an end-of-second-grade raw score of 35 on ORF corresponds to the 30th percentile. All WRMT-R measures have a standard score of 92 that corresponds to the 30th percentile. The final column presents the mean percentile score attained by our sample for that measurement point. For instance, the mean PSF score of 45 for

Table 1
Beginning- and End-of-Grade 30th Percentile or Closest Equivalent Risk Index Scores

Grade	Beginning Eligibility-for-Intervention Score (30th Percentile Scores or Closest Equivalent)	End-of-Year "Out-of-Risk" Score (30th Percentile Scores or Closest Equivalent)
Kindergarten	Five letter names per minute (LNF) (33rd)	20 NWF letter sounds per minute (29th) or 26 phoneme segments (PSF) per minute (30th)
First	20 NWF (33rd) or 36 PSF (30th)	35 words correct per minute (ORF) (30th)
Second	35 ORF (30th)	80 ORF (30th)
Third	66 ORF (30th)	99 ORF (30th)

Note: Numbers in parenthesis represent corresponding percentile ranking. LNF = *Dynamic Indicators of Basic Early Literacy Skills* (DIBELS; Good & Kaminski, 1996) Letter Naming Frequency; NWF = DIBELS Nonsense Word Fluency; ORF = DIBELS Oral Reading Fluency; PSF = DIBELS Phonemic Segmentation Fluency.

Table 2
Mean End-of-Year Assessment Performance for At-Risk Cohort Across Grades Relative to 30th Percentile Indicators

Measure	30th Percentile Score by Measure	Mean Score of Sample	*SD*	Mean Percentile of Sample
End of kindergarten				
PSF[a]	32	45.00	15.27	46
NWF[a]	21	35.90	16.35	63
WRMT-R Word Attack[b]	92	108.20	9.80	69
WRMT-R Word ID[b]	92	103.34	10.59	57
End of first grade				
ORF[a]	35	49.10	34.71	45
WRMT-R Word Attack[b]	92	112.32	11.22	78
WRMT-R Word Identification[b]	92	105.63	12.42	65
WRMT-R Passage Comprehension[b]	92	100.46	9.61	50
End of second grade				
ORF[a]	80	86.20	32.75	35
WRMT-R Word Attack[b]	92	109.22	11.95	73
WRMT-R Word Identification[b]	92	105.15	10.55	63
WRMT-R Passage Comprehension[b]	92	100.78	7.83	52
End of third grade				
ORF[a]	99	100.00	35.20	31
WRMT-R Word Attack[b]	92	108.17	11.14	70
WRMT-R Word Identification[b]	92	103.76	11.52	60
WRMT-R Passage Comprehension[b]	92	97.93	7.91	44

Note: $N = 41$. PSF = *Dynamic Indicators of Basic Early Literacy Skills* (DIBELS; Good & Kaminski, 1996) Phonemic Segmentation Fluency; NWF = DIBELS Nonsense Word Fluency; WRMT-R = *Woodcock Reading Mastery Tests–Revised* (Woodcock, 1987); ORF = DIBELS Oral Reading Fluency.
a. Raw scores.
b. Standard scores.

our sample at the end of kindergarten corresponds to the 46th percentile in the DIBELS systemwide database. The mean score for our sample on ORF of 49.10 at the end of first grade equates to the 45th percentile. A mean score of 109.22 on WRMT Word Attack at the end of second grade equates to the 73rd percentile.

Descriptive statistics indicate that the mean scores of the at-risk group of students who received kindergarten intervention exceeded the 30th percentile at all measurement points and on all measures. Response trends emerged early, as evidenced by end-of-kindergarten performance on DIBELS PSF and NWF, which positioned children in the at-risk cohort comparable to the 45th and 63rd percentiles, respectively. WRMT-R measures likewise documented response ranges that exceeded the 50th percentile on the majority of measures and assessment

Table 3
Risk Pattern Based on WRMT-R Word Attack (First Through Third Grade)

Pattern						Kindergarten Intervention Condition	
First Grade Begin	First Grade End	Second Grade Begin	Second Grade End	Third Grade End	Count	HE-C	Others
Out	Out	Out	Out	Out	37 (90.2%)	15 (93.8%)	22 (88%)
Risk	Out	Out	Out	Out	2 (4.9%)	1 (6.2%)	1 (4%)
Risk	Out	Risk	Risk	Risk	1 (2.4%)	0	1 (4%)
Risk	Risk	Risk	Risk	Risk	1 (2.4%)	0	1 (4%)
Total					41 (100%)	16 (100%)	25 (100%)

Note: WRMT-R = *Woodcock Reading Mastery Tests–Revised* (Woodcock, 1987); HE-C = highly explicit, code-emphasis intervention; Out = out of risk; Risk = still at risk.

Table 4
Risk Pattern Based on WRMT-R Word Identification (First Through Third Grade)

Pattern						Kindergarten Intervention Condition	
First Grade Begin	First Grade End	Second Grade Begin	Second Grade End	Second Grade End	Count	HE-C	Others
Out	Out	Out	Out	Out	32 (78%)	14 (87.5%)	18 (72%)
Risk	Out	Out	Out	Out	2 (4.9%)	0	2 (8%)
Out	Out	Risk	Out	Out	1 (2.4%)	1 (6.3%)	0
Risk	Risk	Out	Out	Out	1 (2.4%)	0	1 (4%)
Out	Risk	Risk	Out	Out	1 (2.4%)	0	1 (4%)
Risk	Risk	Risk	Out	Out	1 (2.4%)	0	1 (4%)
Out	Out	Out	Out	Risk	1 (2.4%)	1 (6.3%)	0
Risk	Risk	Risk	Risk	Risk	2 (4.9%)	0	2 (8%)
Total					41 (100%)	16 (100%)	25 (100%)

Note: WRMT-R = *Woodcock Reading Mastery Tests–Revised* (Woodcock, 1987); HE-C = highly explicit, code-emphasis intervention; Out = out of risk; Risk = still at risk.

points. Word Attack performance consistently ranked higher than Word Identification, followed by Passage Comprehension. ORF was consistently the most stringent of indicators, with average percentile rankings ranging from 45 to 31 across Grades 1 through 3.

Impact and Response to Intervention

Mean performance notwithstanding, a critical objective of our research was to evaluate reading status alterability (e.g., from at risk to above 30th percentile on standardized measures) of children identified as at risk of reading difficulty in kindergarten. A critical RTI question is linked to the probability that children identified as being at risk in kindergarten who receive small-group supplemental intervention actually move out of risk (> 30th percentile) at intervals from kindergarten through third grade. In particular, are there performance patterns of children that characterize RTI across grades?

To investigate RTI, we created predominant risk patterns across kindergarten through Grade 3 using the 30th percentile score of different screeners as cutoff values. Students who exceeded the 30th percentile on beginning-of-year screeners (i.e., NWF and PSF in fall of Grade 1, ORF in fall of Grades 2 and 3) were considered "out of risk"; students who fell below the screening cut scores were considered at risk and received intervention. Secondary analyses were also conducted to determine whether specific kindergarten interventions differentially benefited students at risk of reading difficulty.

Tables 3 through 6 present risk patterns by measure and compare response by kindergarten intervention condition (i.e., HE-C contrasted with the combined performance of the two other interventions, HE-CC and ME-C). Children who performed at or above the 30th percentile were identified as out of risk. For each screener, the probability of being classified as out of risk was compared

Table 5
Risk Pattern Based on WRMT-R Passage Comprehension (First Through Third Grade)

Pattern					Kindergarten Instructional Condition	
	First Grade End	Second Grade End	Third Grade End	Count	HE-C	Others
Out	Out	Out	Out	24 (58.5%)	11 (68.7%)	13 (52%)
Risk	Out	Out	Out	12 (29.3%)	5 (31.3%)	7 (28%)
Risk	Risk	Out	Out	2 (4.9%)	0	2 (8%)
Risk	Risk	Risk	Risk	3 (7.3%)	0	3 (12%)
Total				41 (100%)	16 (100%)	25 (100%)

Note: WRMT-R = *Woodcock Reading Mastery Tests–Revised* (Woodcock, 1987); HE-C = highly explicit, code-emphasis intervention; Out = out of risk; Risk = still at risk.

Table 6
Risk Pattern Based on Oral Reading Fluency (First Through Third Grade)

Pattern							Kindergarten Instructional Condition	
First Grade Begin	First Grade End	Second Grade Begin	Second Grade End	Third Grade Begin	Third Grade Out	Count	HE-C	Others
Out	Out	Out	Out	Out	Out	13 (31.7%)	8 (50%)	5 (20%)
Risk	Out	Out	Out	Out	Out	2 (4.9%)	1 (6.3%)	1 (4%)
Risk	Out	Out	Out	Risk	Out	1 (2.4%)	0	1 (4%)
Risk	Risk	Out	Out	Out	Out	2 (4.9%)	0	2 (8%)
Out	Out	Out	Risk	Risk	Out	1 (2.4%)	1 (6.3%)	0
Out	Out	Out	Out	Out	Risk	2 (4.9%)	1 (6.3%)	1 (4%)
Out	Out	Risk	Out	Risk	Risk	1 (2.4%)	0	1 (4%)
Risk	Out	Out	Out	Risk	Risk	1 (2.4%)	0	1 (4%)
Risk	Risk	Risk	Risk	Out	Out	1 (2.4%)	0	1 (4%)
Out	Out	Risk	Risk	Risk	Risk	2 (4.9%)	1 (6.3%)	1 (4%)
Risk	Out	Risk	Risk	Risk	Risk	1 (2.4%)	0	1 (4%)
Out	Risk	Out	Out	Out	Risk	2 (4.9%)	1 (6.3%)	1 (4%)
Risk	Risk	Risk	Out	Out	Risk	1 (2.4%)	0	1 (4%)
Risk	Risk	Risk	Out	Risk	Risk	1 (2.4%)	0	1 (4%)
Out	Risk	Out	Risk	Risk	Risk	1 (2.4%)	0	1 (4%)
Risk	Risk	Risk	Risk	Out	Risk	1 (2.4%)	0	1 (4%)
Risk	Risk	Out	Risk	Risk	Risk	1 (2.4%)	0	1 (4%)
Risk	Risk	Risk	Risk	Risk	Risk	7 (17.1%)	3 (18.8%)	4 (16%)
Total						41 (100%)	16 (100%)	25 (100%)

Note: HE-C = highly explicit, code-emphasis intervention; Out = out of risk; Risk = still at risk.

with the probability of being classified as at risk by logistic regression analysis at the beginning of first grade and the end of third grade, respectively. For WRMT-R Word Attack at the beginning of first grade, the probability of being classified as out of risk (90.2%) was statistically higher ($p < .05$) than the probability of being classified as at risk (9.7%). At the end of third grade, the probability of being classified as out of risk increased to 95.1%, whereas the probability of being classified as at risk was reduced to 4.9%. In terms of performance by kindergarten intervention condition, although a higher percentage of students in the HE-C group attained out-of-risk status earlier, no statistically significant difference was found between the two intervention conditions on the change of risk status at the beginning of first grade and the end of third grade, respectively. All but two students were out of risk as measured by WRMT-R Word Attack by the end of third grade.

A similar pattern of results was found in WRMT-R Word Identification. The probability of being classified as out of risk (85.4%) was statistically higher ($p < .05$) than the probability of being classified as at risk (14.6%) at the

beginning of first grade. At the end of third grade, the probability of being classified as out of risk increased to 92.7%, whereas the probability of being classified as at risk was reduced to 7.3%. Response by kindergarten intervention condition revealed that the majority of students across conditions responded to kindergarten intervention in a similar way, with all but three students performing above the 30th percentile by the end of third grade.

For WRMT Passage Comprehension, although the probability of being classified as out of risk (58.5%) was still higher than the probability of being classified as at risk (41.5%) at the beginning of first grade, this difference was not statistically significant ($p > .10$). On the other hand, the probability of being classified as out of risk (92.7%) was statistically higher ($p < .05$) than the probability of being classified as at risk (7.3%) at the end of third grade. Analysis of response patterns in Table 5 indicates a strong level of response in first grade (29.3%) in Passage Comprehension. No statistically significant differences were found between the kindergarten intervention conditions on the change of risk status based on WRMT-R Passage Comprehension at the beginning of first grade and the end of third grade.

Because ORF was not measured in the fall of first grade, we used a combination of DIBELS PSF and NWF to identify students at risk. ORF patterns, including first-grade DIBELS, reveal more complex patterns of response than previous measures. Based on the combination measure, the probability of being classified as out of risk (53.7%) was slightly higher than the probability of being classified as at risk (46.3%) at the beginning of first grade; however, this difference was not statistically significant ($p > .05$). Similarly, by the end of third grade, the probability of being classified as out of risk (49%) was not statistically different ($p > .05$) from the probability of being classified as at risk (51%), indicating that many students failed to attain the 30th percentile score of 99 correct words per minute. Unlike previous measures, ORF revealed distributed response patterns across measurement points and for approximately 18% of students with low and stable risk patterns.

Regarding response by kindergarten intervention condition, at the beginning of first grade, the odds of students' being classified as at risk based on PSF and NWF was statistically lower ($\beta = -1.50$, $p < .05$) in the HE-C group than in other intervention groups. The odds of a child in the HE-C program's being classified as at risk at the beginning of first grade was .34 (or the probability of a child in the HE-C group's being classified as at risk at the beginning of first grade was .25). On the other hand, the odds of a child in other groups' being classified as at risk at the beginning of first grade was 1.51 (or the probability of children in other intervention programs' being classified as at risk at the beginning of first grade was .60). A similar pattern was also found at the beginning of third grade. That is, the odds (and probability; P) of a child's to be classified as at risk was lower in the HE-C group ($Odds_{risk\_ERI} = .60$, $P_{risk\_ERI} = .38$) than in other groups ($Odds_{risk\_Other} = 1.50$, $P_{risk\_Other} = .60$); however, this was not statistically significant ($p > .05$).

Table 7
Number and Percentage of Children Out of Risk at End of Third Grade by Measure

Measure	30th Percentile	15th Percentile
WRMT-R: Word Attack	39/41 (95%)	40/41 (98%)
WRMT-R: Word Identification	38/41 (93%)	40/41 (98%)
WRMT-R: Passage Comprehension	38/41 (93%)	40/41 (98%)
Oral Reading Fluency	20/41 (49%)	31/41 (76%)

Note: WRMT-R = *Woodcock Reading Mastery Tests–Revised* (Woodcock, 1987).

Table 7 summarizes the number and percentage of students who were out of risk by measure at the end of Grade 3. To unpack the construct of risk, we present descriptive data for the 30th and 15th percentiles, respectively. Whereas the 30th percentile has been identified as a benchmark of adequate reading proficiency, the 15th percentile has been used in previous research as an index of very poor or extremely low reading performance (Scanlon et al., 2005; Torgesen et al., 1999) that requires intensive, systematic intervention.

Discussion

In this study, we examined the performance of 41 students identified at the beginning of kindergarten as at risk for experiencing reading difficulties and followed them through the end of third grade. All students received intensive, small-group intervention in kindergarten that focused on code-based reading skills. In addition, students still performing below the 30th percentile at the beginning of first grade continued to receive intervention. Each of the 41 students was reevaluated at the beginning of the second and third grades and was provided intervention if scores fell below the 30th percentile on DIBELS ORF.

A primary purpose was to determine whether timely, sustained, small-group instruction informed by student responsiveness could alter the reading trajectories of students at risk of reading difficulties and help them

attain a level of reading performance similar to that of their peers who were not at risk. In other words, could an RTI approach to intervention normalize the reading achievement of at-risk students by the end of third grade?

The primary findings underscore the absolute and relative benefits conferred through explicit code-based reading intervention beginning in kindergarten. Our average student could identify three letter names in the fall of kindergarten, placing him or her at the 25th percentile in a systemwide database of approximately 37,000 students (Good et al., 2002). Consistent with the findings of prior research involving students with comparable entry-level performance (O'Connor et al., 2005; Scanlon et al., 2005), the majority of children identified as at risk in the beginning of kindergarten responded early and positively to intervention. On average, children who performed below the 30th percentile at screening performed at the 46th and 63rd percentiles on PSF and NWF measures, respectively, and at the 69th and 57th percentiles on norm-referenced Word Attack and Word Identification measures, respectively, at the end of kindergarten. Perhaps more important, these performance levels were sustained through third grade and across measures. On only one measure, ORF, did average performance hover below the 40th percentile. At the end of first grade, the average reading fluency rate was 49 words correct per minute (WCPM), compared to 39 WCPM observed in the Vadasy et al. (2006) study and 34 WCPM in the O'Connor et al. (2005) RTI study. Of course, entry-level differences may account for end-of-first-grade performance differences.

In sum, absolute performance levels, on average, across a range of reading measures attained at the end of kindergarten positioned students for trajectories of reading performance that exceeded the 50th percentile on the majority of measures. This finding is noteworthy, as participating students performed below the 30th percentile at the beginning of kindergarten.

In contrast to the findings of Juel (1988) and other non-intervention longitudinal studies, the typical at-risk student in this study not only moved out of risk but stayed out of risk during the kindergarten-through-Grade-3 period. "Out of risk" was indexed using the 30th percentile on normative and criterion-referenced measures. This is an important point of discussion, as risk criteria may be based on absolute (standardized cut scores) or relative performance (ranking within a particular cohort or grade of children). Juel studied the performance of students who performed in the bottom quartile in reading comprehension at the end of first grade and described performance in terms of grade equivalents. The current study identified children in the first 2 months of kindergarten based on a measure of letter-naming fluency. Students also performed in the bottom quartile of their kindergarten peers on a measure of phonemic awareness. In Juel's study, 24 of 29 children, or 88%, read at a level of least 6 months below an appropriate grade equivalent at the end of fourth grade. In the current study, 38 of 41 (93%) kindergarten children identified as at risk scored at or above the 30th percentile on the WRMT-R Passage Comprehension measure at the end of third grade. Clearly, there are marked differences in identification time, measure, and index of response (i.e., grade equivalent or 30th percentile) between studies. Yet the answer to our primary question appears clear: The majority of children identified as at risk of reading difficulty can and did attain adequate levels of reading proficiency. Reading risk among our children was permeable when they received early, high-quality, small-group, code-focused intervention. Juel noted that "there is unbounded optimism among teachers . . . given time, something will happen" (p. 444). Unfortunately, descriptive nonintervention research documents the stability and constancy of poor reading achievement unless early intervention is provided and maintained.

Results of across-grade risk patterns also allowed us to examine points in time when reading proficiency was attained and the stability or constancy of reading proficiency. That is, we were able to determine if there were predominant response periods when students attained adequate levels of reading proficiency and whether they sustained adequate levels without additional intervention. Findings vary by measure. On all measures of the WRMT-R, the majority of students were out of risk by the end of kindergarten. Thus, a critical response period is kindergarten for foundational word reading skills. Passage Comprehension trends lagged behind Word Attack and Word Identification; however, by the end of first grade, 88% (36/41) of students scored at or above the 30th percentile, with the mean group performance falling at or above the 50th percentile through Grade 3. ORF was the most discriminating and dynamic of the reading measures, with 21 of 41 students failing to reach the 99 WCPM criterion. Examination of risk patterns indicted that 16 of 41 students moved in and out of risk on ORF, patterns unlike those observed in other measures. O'Connor et al. (2005) likewise documented this transience among students on skills that became increasingly complex.

A number of explanations may be offered for lower response rates on fluency measures. One is that students scored lower on the ORF measure because interventions did not target this area of reading. We believe that this explanation is unlikely, however, because fluency was a central focus of our intervention beginning in the middle of first grade. A second explanation is that different aspects of reading achievement are less responsive to

intervention, especially for students with early risk profiles. This explanation is supported by the findings of previous intervention studies conducted with students in Grades 2 through 4 (Lovett et al., 2000, cited in O'Connor et al., 2005; Torgesen, 2001). In the present study, 31 of 41 (76%) students read at or above the 15th percentile (77 WCPM); however, reaching the benchmark of 100 WCPM will require an increased level of instructional intensity.

An alternative explanation is supported by examining response by intervention patterns. Primary analyses focused on omnibus RTI patterns that represented the combined effects of kindergarten intervention. Secondary analyses contrasted the effects of the HE-C, to the combined interventions that represented 30-minute interventions either of less specificity or with a combined emphasis (code and comprehension). At the beginning of first grade, a significant association was found between kindergarten intervention and being identified as not being at risk. That is, the probability of a child in the HE-C group's falling below the PSF and NWF screening cut scores was .25, whereas the probability of children in the other intervention programs' being classified as at risk at the beginning of first grade was .60. At the end of third grade, 38% of students in the HE-C condition fell below the 30th percentile ORF cut score of 99 WCPM, whereas 60% of students in the other conditions failed to attain out-of-risk status. Though efforts to improve fluency often do not begin until second grade or later, current findings suggest that critical foundation skills that are attained early may influence later fluency performance. A final explanation for the discrepant findings between WRMT-R and ORF is that the WRMT-R subtests provided inflated results for our students. Recently, D. Fuchs, Fuchs, and Compton (2004) reached a similar conclusion about the WRMT-R and questioned its use for evaluating intervention effects.

In summary, these findings are important, as they allow us to document the alterability of reading performance on the majority of measures used and the critical window of intervention opportunity. Risk patterns revealed that trajectories for Word Attack and Word Identification are established by the beginning first grade and with Passage Comprehension response attained for the majority of children by the end of first grade. Apart from reading fluency, once skills are established, they remain established. The findings corroborate those of prior kindergarten-initiated interventions (O'Connor et al., 2005; Scanlon et al., 2005; Torgesen et al., 1999; Vadasy et al., 2006) supporting the jumpstart that can be attained. In our present study, the percentage of children who performed below the 15th percentile on WRMT-R measures was only 2%. This is a most hopeful finding, given that all students began at or below the 30th percentile on the screening measure.

Limitations and Implications

Findings of our study are restricted to a sample of 41 children whose reading progress was studied over a 4-year period and clearly warrant replication and extension. Our study sought to standardize risk indices by instituting scores on DIBELS PSF or NWF or ORF corresponding to the 30th percentile. We further examined risk using the 15th percentile as an index of very poor reading achievement. By design, students who fell on the cusp, either 29th or 31st percentile, may not be qualitatively different readers but, on the basis of our schema, were designated as at risk or out of risk. We coupled these relative indicators with absolute performance levels to provide indications of how students were performing in relation to established norms. Certainly, risk can be determined along a number of dimensions, such as examined by Vadasy (e.g., dual discrepancy, criterion scores). Nonetheless, it seems important that as a field we begin to find common ground on the criteria used to indicate response and risk. Moreover, the heterogeneity among children identified as at risk by measure requires further study. As schools operationalize RTI and use precious resources to provide supplemental intervention, we are compelled to use measures that accurately identify and index response. Of the longitudinal studies reviewed in this manuscript, each used variations of measures: either timed or untimed letter naming or combinations of phonemic and alphabetic tasks and criteria, relative (performance in the bottom 25th percentile of the cohort) or absolute (all students performing below a cut point). In addition, screening periods varied, with some screening as early as September and October and other studies screening in the second half of kindergarten.

To standardize our identification criteria, we used a letter-naming fluency measure. We do not, however, advise restricting identification screening to one measure. Our students also performed in the bottom quartile of their kindergarten cohort on a phonological awareness measure. Though letter naming is defensible as a strong predictor at the beginning of kindergarten, additional measures may be important to enhance measurement sensitivity and specificity. Schatschneider et al. (2004) noted that although predictor variables may be highly correlated with reading outcomes, they are not without potential problems, such as false positives and false negatives. Specifically, in a current study we are conducting, we screened teacher-nominated kindergarteners for early

reading risk and found a group of children who exceeded the 30th percentile on letter naming but had limited phonological awareness. This group, therefore, would not have been included in the kindergarten intervention reported in this article had we restricted inclusion criteria to only letter naming. The important issue of risk indicators has important implications not only for identifying candidates for interventions but also for comprehensive instructional planning.

RTI, by design, requires a dynamic, well-orchestrated use of measures and intervention to optimize student performance. Unlike O'Connor et al.'s (2005) study, which made multiple adjustments to intervention within an academic year, the current investigation used standard protocol interventions and differentiated instruction primarily at the beginning of the year on the basis of student performance. In Grades 2 and 3, in particular, placement tests were administered and instruction was tailored to the instructional needs of students. Nonetheless, the present study did not capitalize on frequent within-year adjustments that are central to RTI. For second and third graders, this may have been too late to obtain optimal response. This lack of adjustment was not an oversight but reflects a reality of schools and available resources. We speculate that with a more dynamic system, some children would have attained adequate, sustainable levels of reading achievement prior to year-end and could have been discontinued from intervention, whereas other children may have benefited from more individually tailored interventions.

From this study and recently conducted randomized controlled trials and alternative designs, we have converging evidence documenting the alterability of early reading risk. Moreover, findings support that response does not occur at equal intervals over time. Rather, results indicate strong and stable levels of response on phonemic and alphabetic tasks in kindergarten accompanied by comprehension growth in first grade. These findings are important as schools begin to implement RTI. Specifically, current models of RTI propose that children pass through multiple levels of instruction before qualifying for more intensive intervention. If there is a critical window of opportunity when skills can be more readily altered, do the multiple levels of intervention ostensibly compromise our ability to take advantage of this instructional window and best leverage scarce instructional time? Is there a need to broaden RTI models to allow for more intensive intervention earlier rather than later that may ultimately be more effective than a gated sequence of standard protocol interventions? For example, if kindergarten presents a particularly valuable instructional opportunity when intervention may be differentially more effective and efficient than at other points in time, should students at risk on screening measures move directly into intensive intervention? Do the benefits of this approach outweigh the probability that screening measures will most likely identify more false positives than at other points in time?

Moreover, the majority of students were on track to reach fluency benchmarks by the end of first grade. This should not be construed to mean that fluency trajectories are established by first grade. Rather, instructional factors that mediate fluency continue to warrant investigation.

In conclusion, our findings suggest a temporal element that can enhance the effects of intervention. Moreover, results indicate that once established, reading proficiency can be sustained, and on the majority of measures, once students moved out of risk, they were unlikely to move back into risk. In addition to documenting the stability of poor reading achievement, Juel (1988) likewise documented a .87 probability that a child identified as an average reader in first grade would remain an average reader in fourth grade. Consistent with Juel's findings, the present study suggests that even for children identified at risk of reading difficulty in kindergarten, strong positive reading trajectories established by the end of kindergarten and enhanced in first grade beget later reading proficiency.

References

Cavanaugh, C., Kim, A., Wanzek, J., & Vaughn, S. (2004). Kindergarten reading interventions for at-risk students: Twenty years of research. *Learning Disabilities: A Contemporary Journal*, *2*(1), 9-21.

Coleman, M. R., Buysse, V., & Neitzel, J. (2006). *Recognition and response: An early intervening system for young children at-risk for learning disabilities. Full report*. Chapel Hill: University of North Carolina, Frank Porter Graham Child Development Institute.

Denton, C. A., Fletcher, J. M., Anthony, J. L., & Francis, D. J. (2006). An evaluation of intensive intervention for students with persistent reading difficulties. *Journal of Learning Disabilities*, *39*(5), 447-466.

Dickman, G. E. (2006). *RTI and reading: Response to intervention in a nutshell*. Baltimore: International Dyslexia Association.

Dunn, L., & Dunn, L. (1981). *Peabody Picture Vocabulary Test–Revised*. Circle Pines, MN: American Guidance Services.

Francis, D. J., Shaywitz, S. E., Stuebing, K. K., Shaywitz, B. A., & Fletcher, J. M. (1996). Developmental lag versus deficit models of reading disability: A longitudinal individual growth curves analysis. *Journal of Educational Psychology*, *88*, 3-17.

Foorman, B. R., Breier, J. I., & Fletcher, J. M. (2003). Interventions aimed at improving reading success: An evidence-based approach. *Developmental Neuropsychology*, *24*(2/3), 613-639.

Foorman, B. R., Francis, D. J., Fletcher, J. M., Schatschneider, C., & Mehta, P. (1998). The role of instruction in learning to read: Preventing reading failure in at-risk children. *Journal of Educational Psychology*, *90*, 37-55.

Foorman, B. R., & Torgesen, J. (2001). Critical elements of classroom and small-group instruction promote reading success in all children. *Learning Disabilities Research and Practice*, *16*(4), 203-212.

Fuchs, D., Fuchs, L. S., & Compton, D. L. (2004). Identifying reading disabilities by responsiveness to instruction: Specifying measures and criteria. *Learning Disability Quarterly*, *27*, 216-228.

Fuchs, L., Fuchs, D., Hosp, M., & Jenkins, J. (2001). Oral reading fluency as an indicator of reading competence: A theoretical, empirical, and historical analysis. *Scientific Studies of Reading*, *5*, 239-256.

Good, R. H., & Kaminski, R. (1996). *Dynamic indicators of basic early literacy skills*. Eugene: University of Oregon.

Good, R. H., Wallin, J., Simmons, D. C., Kame'enui, E. J., & Kaminski, R. A. (2002). *System-wide percentile ranks for DIBELS benchmark assessment* (Technical Report 9). Eugene: University of Oregon.

Good, R. H., III, Simmons, D. C., & Kame'enui, E. J. (2001). The importance of decision-making utility of a continuum of fluency-based indicators of foundational reading skills for third-grade high-stakes outcomes. *Scientific Studies of Reading*, *5*, 257-288.

Hieronymous, A. N., Lindquist, E. F., & Hoover, H. D. (1980). *IOWA Test of Basic Skills*. New York: Houghton Mifflin.

Juel, C. (1988). Learning to read and write: A longitudinal study of 54 children from first to fourth grades. *Journal of Educational Psychology*, *80*(4), 437-447.

Kaminski, R., & Good, R. (1996). Toward a technology for assessing basic early literacy skills. *School Psychology Review*, *25*, 215-227.

Lovett, M. W., Lacerenza, L., & Borden, S. L. (2000). Putting struggling readers on the PHAST track: A program to integrate phonological and strategy-based remedial reading instruction and maximize outcomes. *Journal of Learning Disabilities*, *33*(5), 458-476.

Lyon, G. R., & Chhabra, V. (1996). The current state of science and the future of specific reading disability. *Mental Retardation and Developmental Disabilities Research Reviews*, *2*, 2-9.

MacGinitie, W. H., Kamons, J., Kowalski, R. L., MacGinitie, R. K., & MacKay,T. (1978). *Gates-MacGinitie Reading Tests*. Toronto, Ontario: Nelson.

National Joint Committee on Learning Disabilities. (2005). *Responsiveness to intervention and learning disabilities*. Available from http://www.ldonline.org

National Reading Panel. (2000, April). *Teaching children to read: An evidence-based assessment of the scientific research literature on reading and its implications for reading instruction*. Washington, DC: National Institute of Child Health and Human Development.

O'Connor, R. (2000). Increasing the intensity of intervention in kindergarten and first grade. *Learning Disabilities Research and Practice*, *15*(1), 43-54.

O'Connor, R. E., Fulmer, D., Harty, K. R., & Bell, K. (2005). Layers of reading intervention in kindergarten through third grade: Changes in teaching and student outcomes. *Journal of Learning Disabilities*, *38*, 440-455.

Phillips, L. M., Norris, S. P., Osmond, W. C., & Maynard, A. M. (2002). Relative reading achievement: A longitudinal study of 187 children from first through sixth grade. *Journal of Educational Psychology*, *94*, 3-13.

Scanlon, D. M., Vellutino, F. R., Small, S. G., Fanuele, D. P., & Sweeney, J. M. (2005). Severe reading difficulties—Can they be prevented? A comparison of prevention and intervention approaches. *Exceptionality*, *13*, 209-227.

Schatschneider, C., Fletcher, J., Francis, D., Carlson, C., & Foorman, B. (2004). Kindergarten prediction of reading skills: A longitudinal comparative study. *Journal of Educational Psychology*, *96*, 265-282.

Simmons, D., Kame'enui, E., Harn, B., Coyne, M., Edwards, L., & Thomas, C. (2007). The effects of instructional emphasis and specificity on early reading and vocabulary development of kindergarten children. *Journal of Learning Disabilities, 40*, 331-347.

Simmons, D. C., Kame'enui, E. J., Stoolmiller, M., Coyne, M. D., & Harn, B. (2003). Accelerating growth and maintaining proficiency: A two-year intervention study of kindergarten and first-grade children at risk for reading difficulties. In B. Foorman (Ed.), *Preventing and remediating reading difficulties: Bringing science to scale* (pp. 197-228). Timonium, MD: York.

Torgesen, J. K. (2000). Individual differences in response to early interventions in reading: The lingering problem of treatment resisters. *Learning Disabilities Research and Practice*, *15*(1), 55-64.

Torgesen, J. K., Alexander, A.W., Wagner, R. K., Rashotte, C.A, Voeller, K.S., & Conway, T. (2001). Intensive remedial instruction for children with severe reading disabilities: Immediate and long-term outcomes from two instructional approaches. *Journal of Learning Disabilities*, *34*, 33-58, 78.

Torgesen, J. K., Wagner, R. K., Rashotte, C. A., Rose, E., Lindamood, P., Conway, T., et al. (1999). Preventing reading failure in young children with phonological processing disabilities: Group and individual responses to instruction. *Journal of Educational Psychology*, *91*, 1-15.

Vadasy, P., Sanders, E., & Peyton, J. (2006). Code-oriented instruction for kindergarten students at risk for reading difficulties: A randomized field trial with paraeducator implementers. *Journal of Educational Psychology*, *98*(3), 508-528.

Vaughn, S., & Fuchs, L. S. (2003). Redefining learning disabilities as inadequate response to instruction: The promise and potential problems. *Learning Disabilities Research and Practice*, *18*(3), 137-146.

Vellutino, F., Scalon, D., Silpay, E., Small, S., Pratt, A., Chen, R., et al. (1996). Cognitive profiles of difficult-to-remediate and readily remediated poor readers: Early intervention as a vehicle for distinguishing between cognitive and experiential deficits as basic causes of specific reading disability. *Journal of Educational Psychology*, *88*, 601-638.

Woodcock, R. W. (1987). *Woodcock Reading Mastery Tests–Revised (WRMT-R) examiner's manual*. Circle Pines, MN: American Guidance Service.

Woodcock, R. W., & Johnson, M.B. (1989). *Woodcock-Johnson Psychoeducational Battery*. Allen, TX: DLM Teaching Resources.

Deborah C. Simmons, PhD, is a professor of special education in the Department of Educational Psychology at Texas A&M University. Her current research focuses on the prevention and intervention of reading disabilities in the primary grades and response to intervention.

Michael D. Coyne, PhD, is an associate professor of special education and educational psychology at the Neag School of Education at the University of Connecticut, where he studies beginning reading and vocabulary interventions and school-wide literacy supports.

Oi-man Kwok, PhD, is an assistant professor of educational psychology at Texas A&M University. His research includes the application of structural equation modeling and multilevel modeling techniques on analyzing longitudinal data.

Sarah McDonagh, PhD, is a lecturer in special education at Charles Sturt University in New South Wales, where her interests include instructional interventions for students at risk for reading difficulties, data-based decision making, and response to intervention.

Beth A. Harn, PhD, is an assistant professor in special education at the University of Oregon, where her research and teaching interests are in instructional design, assessment for instructional decision making, prevention and early intervention, and system-level coordination of instructional decision making in reading.

Edward J. Kame'enui, PhD, is the Dean-Knight Professor of Education and the director of the Center on Teaching and Learning at the University of Oregon, where he directs research on early literacy. He recently returned to the University after serving as the first commissioner of the National Center for Special Education Research.