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# Characteristics of Children Who Are Unresponsive to Early Literacy Intervention

## *A Review of the Literature*

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### ABSTRACT

This article reviews the research literature that describes children who are unresponsive to generally effective early literacy interventions. Studies were selected in which (a) children ranged from preschoolers to third graders and were at risk for reading disabilities, (b) treatments targeted early literacy, (c) outcomes reflected reading development, and (d) students' unresponsiveness to intervention was described. The literature review included a computer search of several databases, an ancestral search of relevant articles and books, and a manual search of 11 journals. Twenty-three studies were identified, 8 of which were designed primarily to identify characteristics of unresponsive students; the remaining 15 studies focused on treatment effectiveness but also identified and described unresponsive students. A majority of unresponsive students had phonological awareness deficits. Additional characteristics included phonological retrieval or encoding deficits, low verbal ability, behavior problems, and developmental delays. Finally, methodological issues are discussed that complicate comparisons of nonresponders across studies, and implications for future research are described.

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**R**ESearch suggests that most reading difficulties are associated with core deficits in phonological processing (e.g., Adams, 1990; Snow, Burns, & Griffin, 1998; Torgesen, Wagner, & Rashotte, 1994). Reading problems have

also been connected to naming-speed deficits, which are demonstrated by poor performance on rapid automatized naming tasks (Denckla & Rudel, 1976; Wolf, 1991; Wolf & Bowers, 1999). What begins with a deficit in one or both of these areas is believed to develop into reading dysfluency (Felton, 1993; Jorm & Share, 1983; Stanovich, 1986; Wolf & Bowers, 1999), which in turn negatively affects children's comprehension of text (Bryne, Freebody, & Gates, 1992; Juel, Griffith, & Gough, 1986).

Juel (1988) found that children who were unsuccessful readers in first grade remained poor readers in fourth grade. The gap between poor readers and their more accomplished peers widens over the elementary years (Stanovich, 1986), partly because remediating reading difficulties becomes increasingly challenging after third grade (Fletcher & Foorman, 1994; Kennedy, Birman, & Demaline, 1986; Lyon, 1985). Furthermore, the persistence of reading disabilities throughout school and into adulthood has been well documented (e.g., Juel, 1988; LaBuda & DeFries, 1988; Schonhaut & Satz, 1983). By contrast, children who begin their school careers as successful readers are likely to experience academic success, graduate from high school and college, and find employment (Slavin, Karweit, & Madden, 1989; Snow et al., 1998). Given the pivotal role reading plays in and

out of school and the cumulative long-term cost of illiteracy, early literacy intervention is critical.

## EARLY INTERVENTION: SUCCESSFUL FOR MANY BUT NOT FOR ALL

One promising intervention to promote early literacy is phonological awareness training (Bradley & Bryant, 1985; Cunningham, 1990; Lundberg, Frost, & Petersen, 1988), especially when such training is explicitly linked to reading and writing (Ball & Blachman, 1991; Bryne & Fielding-Barnsley, 1993; Fuchs et al., 2001; Tunmer, Herriman, & Nesdale, 1988). A recent meta-analysis by Bus and Van IJzendoorn (1999) reported relatively strong short-term effects for phonological training on phonological measures ( $ES = .73$ ) and on reading measures ( $ES = .70$ ).

However, few researchers have suggested that either phonological awareness training or beginning decoding instruction is a silver-bullet solution that prevents reading disabilities in all children. Indeed, investigators have reported that as many as 30% of children who are at risk for reading difficulties (Blachman, 1994, 1997; Brown & Felton, 1990; Juel, 1994; Mathes, Howard, Allen, & Fuchs, 1998; Shannahan & Barr, 1995; Torgesen, Morgan, & Davis, 1992) and as many as 50% of children who have special needs (Fuchs et al., 2002; O'Connor, 2000; O'Connor, Jenkins, Leicester, & Slocum, 1993; O'Connor, Jenkins, & Slocum, 1995) may not benefit from generally effective phonological and decoding instruction. Little is currently known about children who are unresponsive to generally effective early literacy interventions or about the nature of interventions that might help them.

Researchers have hypothesized that these children have fine-grained phonological discrimination problems (Brady, 1997; Tallal, 1990), severe phonological awareness weaknesses (Blachman, 1994; Torgesen et al., 1994), naming-speed deficits (Wolf, 1991; Wolf & Bowers, 1999), cognitive or language limitations (Bishop & Adams, 1990; Catts, 1993; Menyuk & Chesnick, 1997), or attention or behavior problems (Ackerman, Dykman, & Gardner, 1990; Felton & Wood, 1989; Shaywitz & Shaywitz, 1996). Because research on this topic is new, the question remains, Are such characteristics important correlates of children's unresponsiveness to treatment?

## PURPOSE AND ORGANIZATION OF THE REVIEW

A greater understanding of the characteristics of children who do not respond to generally effective early literacy treatments, including well-implemented phonological and decoding training, could help researchers design more broadly effective interventions. In addition, identifying child characteristics that predict unresponsiveness to treatment could

improve screening measures and the selection of the most appropriate children for early and intensive intervention (Blachman, 1997). Thus, we conducted a review—to our knowledge, the first—of the literature describing children who did not benefit from beginning reading interventions.

The review is presented in three parts, Method, Results, and Discussion, in which we discuss, respectively, our search to find pertinent research papers, our distillation of reported findings, and our reflections on how the studies were conducted and their importance. The Results section comprises two parts: (a) intervention studies designed primarily to explore characteristics of nonresponders and (b) intervention studies designed primarily to assess treatment effectiveness with limited information on nonresponders. Studies in each of these two parts are further organized by the chronological age and disability status of the participants. In contrast to the Results section, the Discussion section is organized by the learner characteristics of the nonresponsive students.

## METHOD

### *Inclusion Criteria and Search Strategies*

We used five criteria to select studies. First, selected studies were published in peer-reviewed journals. Second, study participants ranged from preschool to third grade. Third, participants included students at risk for reading disabilities (e.g., students with low ability, low phonological awareness, low income, learning disabilities, language disorders). Fourth, interventions targeted early literacy but excluded nonreading interventions, such as visual or perceptual training. Fifth, study outcomes addressed reading development.

The literature search included seven steps. First, we identified the following terms using the Educational Resources Information Center's (ERIC's) thesaurus of descriptors: *reading difficulties*, *remedial reading*, *read* (see Note), *beginning reading*, *reading readiness*, *emergent literacy*, *early intervention*, *training*, *phon* (see Note), *phonological awareness*, *phonemic awareness*, *at-risk*, *disadvantaged*, *low-ability*, *urban*, *learning disability*, *language disorder*, *language impairment*, *elementary education*, and *primary education*. Second, we entered these terms in a computer search of ERIC from 1966 to June 2000; PsychLit from 1967 to June 2000; and Exceptional Child Educational Resources from 1969 to June 2000. Third, we conducted an ancestral search of pertinent studies conducted by Blachman (1994), Torgesen and Davis (1996), Uhry and Shepherd (1997), and Vellutino et al. (1996). Fourth, we examined several books to identify additional studies. These were *Beginning to Read: Thinking and Learning About Print* (Adams, 1990), *Getting Reading Right From the Start* (Hiebert & Taylor, 1994), *Reading Disabilities: A Developmental Language Perspective* (Kamhi & Catts, 1989), *Preschool Prevention of Reading Failure* (Masland & Masland, 1988), *Effective Programs for Students at Risk* (Slavin

et al., 1989), and *Preventing Reading Difficulties in Young Children* (Snow et al., 1998).

Fifth, a manual search was conducted of the following journals from January 1988 to June 2000 or, if the journal was relatively new, from the date of inception to June 2000: *Journal of Educational Psychology*, *Journal of Experimental Child Psychology*, *Journal of Learning Disabilities*, *Journal of Reading Behavior*, *The Journal of Special Education*, *Learning Disability Quarterly*, *Learning Disabilities Research & Practice*, *Reading Research Quarterly*, *Remedial and Special Education*, *Scientific Studies of Reading*, and *Topics in Language Disorders*.

Sixth, the abstracts of all identified articles were scanned to eliminate articles that did not meet the inclusion criteria. Seventh, among remaining articles, study participants, results, and discussion sections were read for descriptions of children who did not benefit from treatments. Studies were excluded if they reported a percentage of children unresponsive to treatment but did not describe those children (e.g., Blachman, 1994; Brown & Felton, 1990; Bryne & Fielding-Barnsley, 1993; Felton & Brown, 1990; Juel, 1994; Mathes et al., 1998; O'Connor et al., 1995; Shannahan & Barr, 1995; Smith-Burke & Jaggard, 1994; Torgesen et al., 1992; Torgesen, Wagner, & Rashotte, 1997).

### **Studies Included in the Review**

Twenty-three pertinent intervention studies were found, reflecting two approaches to the issue at hand. The authors of eight studies tested the effectiveness of various instructional treatments, but they designed their studies with the primary purpose of identifying characteristics of children unresponsive to treatment (Berninger et al., 1999; Hatcher & Hulme, 1999; Schneider, Ennemoser, Roth, & Kuspert, 1999; Torgesen & Davis, 1996; Torgesen et al., 1999; Uhry & Shepherd, 1997; Vellutino, Scanlon, & Lyon, 2000; Vellutino et al., 1996); these studies will be reviewed in depth. The remaining 15 studies were designed principally to examine the effects of various early literacy treatments, but they also described students who did not respond to treatments. For purposes of presentation, we have organized this second group of studies into three subgroups based on the age and disability status of the student participants. More specifically, four studies explored the effectiveness of decoding training for beginning readers without disabilities (Ehri & Robbins, 1992; Fox & Routh, 1976; Peterson & Haines, 1992; Vandervelden & Siegel 1997), five studies examined the effectiveness of programs for young beginning readers with disabilities (Fazio, 1997; Kasten, 1998; O'Connor et al., 1993; O'Connor, Notari-Syverson, & Vadasy, 1996, 1998), and six studies focused on the effectiveness of remedial programs for older students in Grades 1 to 3 (Foorman, Francis, Fletcher, Schatschneider, & Mehta, 1998; Foorman et al., 1997; Hurford, 1990; O'Schaughnessy & Swanson, 2000; Snider, 1997; Vadasy, Jenkins, Antil, Wayne, & O'Connor, 1997). Table 1 presents detailed infor-

mation on the interventions used in each of the 23 studies. Table 2 provides the following for each study: demographic information on participants, data on treatment effectiveness, and the definition of unresponsiveness and the percentage of children identified as unresponsive.

## **RESULTS**

### **Studies Conducted to Explore Characteristics of Unresponsive Children**

The eight intervention studies designed primarily to identify characteristics of children unresponsive to treatment differed in terms of the participating children's ages and the settings in which they received treatment (school or clinic). The studies are grouped into three sections. The first includes three studies in which the researchers implemented interventions that began in kindergarten with preliterate students (i.e., Schneider, Kuspert, Roth, Vise, & Marx, 1999; Torgesen & Davis, 1996; Torgesen et al., 1999). The second two sections describe studies conducted with older children in either schools or clinics.

**Interventions Beginning in Kindergarten.** Torgesen and Davis (1996) were first to explore kindergarten students' unresponsiveness to treatment. The students attended two schools serving mostly low-income African American families. Children were selected if they scored in the lowest 20th percentile on a phonological awareness measure but had not been identified for special services. Phonological awareness training was conducted by graduate students in small-group, 20-min. sessions, four times per week for 4 months. Children were taught to rhyme words, blend sounds together to make words, break words into phonemes using colored counters to represent each phoneme, and, during the last 3 weeks of treatment, to decode words. No fidelity-of-treatment data were reported. Effect sizes favoring treatment students were large: 1.35 for blending and 1.85 for segmenting (Torgesen & Burgess, 1998). Following treatment, however, 35% of the students segmented only one word correctly, and 10% blended two words or less correctly. Torgesen and Davis reported that the regression model that best predicted segmentation growth included pretreatment scores of invented spelling of nonwords and verbal ability. The best predictive model of blending growth included pretreatment scores of invented spelling of nonwords and rapid digit naming.

Schneider et al. (1999) reanalyzed data from a prior study (Schneider et al., 1997), in which participants were German kindergarten students. Whereas Torgesen and Davis's (1996) trainers were graduate students, Schneider et al. (1997) enlisted the children's classroom teachers to conduct phonological awareness training for 10 to 15 min. per day for 6 months. Training included syllable segmentation and blending, identification of initial phonemes, and segmen-

TABLE 1. Treatment Characteristics

Article	Treatment description	Treatment intensity, duration, and fidelity	Treatment effectiveness
<b>Intervention studies conducted to describe unresponsive students</b>			
Berninger et al. (1999)	Graduate students trained children to read words using whole-word instruction, phonemic decoding, or whole-word + phonemic decoding.	Individual tutorials in eight 30-min. sessions. Total = 4 hrs. No fidelity reported.	All three groups made significant growth.
Hatcher & Hulme (1999)	Teachers (not the children's) trained students using either phonological awareness training (P), Reading Recovery (R), or both (P + R).	Individual tutorials in forty 30-min. sessions for 20 weeks. Total = 20 hrs. No fidelity reported.	P group made greater gains on phonological skills than other groups. Only P + R group made greater reading gains than controls and differences continued at 9-mo. follow-up.
Schneider et al. (1999)	Classroom teachers trained their own students using phonological awareness training.	Whole classroom instruction conducted daily in ten 15-min. sessions for 6 mos. Total = 20 hrs. No fidelity reported.	Treatment students outperformed controls on phonological awareness at posttest and on reading at end of Grade 2.
Torgesen & Davis (1996)	Graduate students conducted rhyming, blending, and segmenting training.	Small group format in four 20-min. sessions per week for 3 mos. Total = 16 hrs. No fidelity reported	Treatment students made significantly more growth in blending and segmenting than control students.
Torgesen et al. (1999)	Research staff and instructional aides trained students in phonological awareness + synthetic phonics (PASP) or embedded phonics (EP). A third group received regular classroom support (RCS).	Individual tutorial in four 20-min. weekly sessions (two with staff and two with instructional aide). Total = 88 hrs. No fidelity reported.	PASP group scored higher than the other three groups on WRMT-R, WA, and WI; PASP group also scored higher than controls and RCS on WRMT-R, PC.
Uhry & Shepherd (1997)	Graduate students trained children in letter-sound correspondence and segmentation and provided guided reading in phonics-controlled and narrative texts and guided writing.	Individual tutorial in two 1-hr. sessions per week for 5 mos. Total = 32 hrs. No fidelity reported.	Most students made significant growth in WRMT-R, WI, and WA.
Vellutino et al. (1996, 2000)	Research staff (certified teachers) trained students in phonemic awareness, phonetic decoding, reading in connected text, and writing.	Individual tutorial in five 30-min. sessions per week for 1-2 semesters. Total = 35-40 hrs. No fidelity reported.	67% of tutored students improved beyond lowest 30th percentile on WRMT-R, WI, and WA.
<b>Studies exploring treatment effectiveness: Beginning readers without disabilities</b>			
Ehri & Robbins (1992)	Research staff trained experimental students to read words by analogy (e.g., <i>cave, save</i> ) and trained control students to read unrelated words (e.g., <i>rain, save</i> ).	Individual tutorial in four 15-min. sessions across 1 mo. Total = 1 hr. No fidelity reported.	Significant differences favored experimental students on word reading.

(table continues)

(Table 1 continued)

Article	Treatment description	Treatment intensity, duration, and fidelity	Treatment effectiveness
Fox & Routh (1976)	Research staff trained students to read short words by blending two sounds together (e.g., <i>me</i> ).	Individual tutorial in two 30-min. sessions for 1 week. Total = 1 hr. No fidelity reported.	Significant effects on decoding for experimental students who could segment.
Peterson & Haines (1992)	Research staff trained experimental students to read words by analogy (e.g., /b/ /all/, /ball/; /f/ /all/, /fall/).	Individual tutorial in seven 15-min. sessions across 1 mo. Total = 2 hrs. No fidelity reported.	Significant growth in decoding for experimental students with mid- to high-level segmentation skill.
Vandervelden & Siegel (1997)	Research staff trained students in phonological awareness and reading and spelling using initial sounds and rimes.	Individual or small-group training in one 30–45 min. session per week for 3 mos. Total = 6–9 hrs. No fidelity reported.	Significantly greater growth on phonological awareness and reading for experimental students.
<b>Studies exploring treatment effectiveness: Preliterate children with disabilities</b>			
Fazio (1997)	Research staff taught children to recall and retell a poem using direct instruction under four conditions: with or without hand motions and with or without singing the poem (phonological encoding).	Individual tutoring in four 15-min. sessions across 1 mo. Total = 1 hr. No fidelity reported.	Children with speech or language impairments in the hand motions condition outperformed children in other conditions.
Kasten (1998)	Phonics training in resource room setting; whole-language classroom instruction.	3-year duration No total reported. No fidelity reported.	Student's scores on Reading Miscue Inventory showed he was becoming a developing reader.
O'Connor et al. (1993)	Research staff trained students in either rhyming, blending, or segmenting using direct instruction.	Small group training in four 10-min. sessions per week for 7 weeks. Total = 4.5 hrs. No fidelity reported.	Experimental students made significantly more growth on rhyming, blending, and segmenting.
O'Connor et al. (1996, 1998)	Classroom teachers trained their students in phonological and print awareness.	Whole classroom instruction during 100–281 sessions over 6 mos. No total reported. No fidelity reported.	Experimental students with and without disabilities outperformed controls on blending, segmenting, and word reading on WRMT. Effects continued to favor experimental students with disabilities 1 year after training.
<b>Studies exploring treatment effectiveness: Older children</b>			
Foorman et al. (1997)	Resource room teachers taught their students using synthetic phonics (multisensory and systematic at the phoneme level), analytic phonics (implicit and at the onset-rime level), or sight word (whole word) approaches.	Whole classroom instruction, 1 hr. daily for 6 mos. Total = 120 hrs. No fidelity reported.	Students in synthetic phonics condition performed better than students in sight word condition in segmentation and reading.

(table continues)

Article	Treatment description	Treatment intensity, duration, and fidelity	Treatment effectiveness
Foorman et al. (1998)	Classroom teachers used either direct code, embedded code, or implicit code. Research staff also conducted an implicit code training group. In addition, Title 1 teachers provided students with additional tutoring that was implicit.	Whole classroom instruction was 90 min. daily; small-group or individual tutorial was 30 min. daily. 6-mo. duration No fidelity reported.	Positive effects favored the direct code group on WJ-R Basic Skills and Passage Comprehension subtests.
Hurford (1990)	Research staff trained students to use a computer program that tried to help students discriminate between phonemes (e.g., /ri /li/).	Sessions were 30–45 min. per day for 3–4 days. Total = 2.5–4 hrs. No fidelity reported.	Experimental students displayed significant improvement in segmentation.
Snider (1997)	Students' resource room teacher used direct instruction.	Grouping format not reported. 30–45 min. daily across 9 mos. Total = 90 hrs. No fidelity reported.	Students improved their reading rate and accuracy on oral reading fluency.
O'Shaughnessy & Swanson (2000)	Instructional aides conducted either phonological awareness and phonemic decoding training (PAT), word analogy training (WAT), or math training (MAT).	Small-group format. Three 30-min. sessions across 6 weeks. Total = 9 hrs. Fidelity reported (94%–97%).	PAT and WAT groups outperformed the MAT group on PA, phonological memory, and Word Attack (WRMT-R).
Vadasy et al. (1997)	Community volunteers trained students on phonological awareness, letter–sound correspondence, phonogram activities with magnetic letters, reading, and writing.	Individual tutorial for 100 sessions across 6 mos. Total = 54 hrs. No fidelity reported.	Effect sizes for segmentation and reading on WRMT favored experimental students.

Note. WRMT-R = *Woodcock Reading Mastery Tests–Revised* (Woodcock, 1987); WA = Word Attack; WI = Word Identification; PC = Passage Comprehension; WJ-R = *Woodcock-Johnson Reading* subtests.

tation and blending at the phoneme level. No fidelity-of-treatment information was provided.

Prior to treatment, students were divided into at risk, average, and advanced groups on the basis of their phonological awareness scores. Schneider et al. (1999) reported a wide distribution of pre- to posttreatment gains in phonological awareness. Multiple regression analyses were conducted on the gain scores with pretreatment performance on measures of phonological memory (word span), naming speed, and alliteration skill as predictors. Responsiveness to treatment among the at-risk group was best predicted by word span performance; for average students, alliteration and rapid naming; and for above-average students, alliteration only. However, these predictors failed to account for 75% to 89% of the variance in treatment responsiveness.

In the third and most ambitious effort of this set of investigations, Torgesen et al. (1999) compared the effects of three interventions: (a) phonological awareness plus synthetic phonics (PASP), (b) embedded phonics (EP), and (c) regular classroom support on phonological awareness and reading growth. Study participants' scores were at or below the 12th

percentile on letter naming and phoneme elision, and their general verbal ability was above a standard score of 75.

Participants were randomly assigned to one of the three interventions or to a control group. Students in the PASP and EP interventions received two 20-min. instructional sessions from a tutor and two equally long sessions from an aide each week for five semesters, totaling approximately 88 hours of one-to-one instruction. On phonemic decoding, PASP students made larger gains than the students in the other three groups; on real-word reading, PASP students' growth was superior to the control students' and to that of the students receiving regular classroom support. Nevertheless, 24% of PASP students scored 1 *SD* below the mean of the standardization population on the Word Attack subtest and 21% did so on the Word Identification subtest. These numbers were even greater among EP students (47% and 28%, respectively) and regular classroom support students (44% and 31%, respectively).

Torgesen et al. (1999) used hierarchical linear modeling to identify correlates of reading growth among their study sample. Predictors were analyzed individually and simul-

**TABLE 2. Child Characteristics**

Article	Demographics	Definition and percentage of unresponsive students	Characteristics of unresponsive students
<b>Intervention studies conducted to describe unresponsive students</b>			
Berninger et al. (1999)	<i>M</i> age = 7 yrs., 2% Black, 8% Hispanic, 2% Asian, 4% Native American, <i>M</i> verbal IQ = 91.60	Growth slopes not different from 0. No growth on words trained: 52%; no growth on WRMT-R WA: 63%; no growth on WRMT-R WI: 75%	Low PA, slow RAN, poor orthographic skills, and low verbal IQ
Hatcher & Hulme (1999)	<i>M</i> age = 7 yrs., <i>M</i> IQ = 68–122	Not defined; no percentage reported	Low PA
Schneider et al. (1999)	<i>M</i> age = 5 yrs. 7 mos., German	No gains during treatment; no percentage reported	Slow RAN among students with lowest PA
Torgesen & Davis (1996)	Age: 5–6 yrs., 73% Black, low SES, <i>M</i> verbal IQ approximately 91	No gains during treatment; segmenting: 30%; blending: 10%	Poor invented spelling, slow RAN, and low verbal ability
Torgesen et al. (1999)	Age: 5–6 yrs., 26% Black, verbal IQ > 75	WRMT-R standard score < 85. On the WA, WI, and PC subtests, respectively: controls: 53%, 53%, 56%; PASP: 24%, 21%, 36%; EP: 47%, 28%, 47%; RCS: 44%, 31%, 56%	Low PA, slow RAN, low SES, poor classroom behavior ratings, and poor phonological memory
Uhry & Shepherd (1997)	Age: 5–8 yrs., 17% Black, middle SES, IQ > 90	No gains during treatment; on WRMT-R WI: 8%	Low PA, slow RAN, poor phonological memory, and poor attention
Vellutino et al. (1996, 2000)	Age: 5–8 yrs., Mostly White, middle SES, IQ > 90	Students with lowest growth slopes on WRMT-R WI and WA from K–Fall of 2nd grade: 26%; No improvement beyond 30th percentile on WRMT-R WI and WA: 33%	Low segmentation, slow RAN, poor phonological memory, and poor attention
<b>Studies exploring treatment effectiveness: Beginning readers without disabilities</b>			
Ehri & Robbins (1992)	Age: 5–7 yrs., middle SES.	Unable to read transfer words: 80% of students who could not segment and blend nonsense words; 0% of students who could segment.	No segmentation skills
Fox & Routh (1976)	<i>M</i> age = 4 yrs., middle SES, <i>M</i> IQ = 112	Did not improve during treatment on decoding: 50% overall; 100% of those who could not segment.	No segmentation skills
Peterson & Haines (1992)	Age: 5–6 yrs. PPVT-R > 85	Did not significantly improve word-reading: 33% overall; 100% of poor segmenters.	Poor segmentation

(table continues)

(Table 2 continued)

Article	Demographics	Definition and percentage of unresponsive students	Characteristics of unresponsive students
Vandervelden & Siegel (1997)	Age: 5–7 yrs., low SES.	No gains in PA: 13% overall; 18% of students with low PA. Could not read more than one word: 27% overall; 36% of students with low PA.	Low PA
<b>Studies exploring treatment effectiveness: Preliterate children with disabilities</b>			
Fazio (1997)	Age: 4–6 yrs., <i>M</i> nonverbal IQ = 85–115	Difficulty learning and recalling a rhyming poem: percentage not reported	Low PA and poor verbal ability
Kasten (1998)	<i>M</i> age = 5 yrs., low SES, White	Did not display significant reading growth on WJ-R subtests; No percentage reported	Low IQ
O' Connor et al. (1993)	Age: 4–6 yrs.	Did not learn to identify rhyming oddities: 8%; did not learn to blend onset-rime: 36%; did not learn to segment first sound: 46%	Low PA
O' Connor et al. (1996, 1998)	Age: 5–7 yrs., 56% Black, <i>M</i> Verbal IQ = 67	Made less than half the mean gain in PA: general education students, 18%; students with disabili- ties, 33%; mild mental retardation, 66%; learning disabilities, 38%; behavior disorders, 50%	Low PA and low IQ
<b>Studies exploring treatment effectiveness: Older students</b>			
Foorman et al. (1997)	Age: 7–9 yrs., 32% Black, 24% low SES, Verbal IQ > 79	Not defined; no percentage reported	Low PA, poor spelling, Spanish ethnicity, and low verbal IQ
Foorman et al. (1998)	Grades 1–2, 60% Black, 20% Hispanic, low SES	Learned fewer than 2.5 words on a 50-word list: implicit code–researchers, 46%; implicit code– teachers, 38%; embedded code, 44%; and direct code, 16%	
Hurford (1990)	Age: 7–9 yrs., IQ > 90	Posttreatment segmentation skills are poorer than students without disabilities; No percentage reported	Low PA and younger children
Snider (1997)	Age: 7–9 yrs., 10% low SES	Did not significantly improve reading rate and accuracy on oral reading fluency: 10%	Poor attention
O'Shaughnessy & Swanson (2000)	<i>M</i> age = 7 yrs., 8 mos., 4.4% Black, 2.2% Asian, 28.9% Hispanic, low SES, <i>M</i> IQ = 89.9	Did not significantly improve rate and accuracy on oral reading fluency: phonological training, 20%; word analogy train- ing 27%	Poor attention
Vadasy et al. (1997)	Age: 5–8 yrs., 50% low SES	Gained less than 8 points on the Reading and Spelling subtests of the WRAT-R: 35%	Poor attention

Note. WRMT-R = *Woodcock Reading Mastery Tests–Revised* (Woodcock, 1987); WA = Word Attack; WI = Word Identification; PA = phonological awareness; RAN = rapid automatized naming; SES = socioeconomic status; PPVT-R = *Peabody Picture Vocabulary Test–Revised* (Dunn & Dunn, 1981); WJ-R = Woodcock-Johnson Reading subtests; WRAT-R = *Wide Range Achievement Test–Revised* (Jastak & Wilkinson, 1984).



taneously in sets. In the simultaneous model, phonological awareness, rapid naming, phonological memory, home background, and behavior ratings were significantly related to growth on the Word Attack subtest; rapid naming, home background, and behavior ratings were significantly related to growth on the Word Identification subtest. Low general verbal ability was associated with real-word reading growth only when all phonological and home background variables were removed from analyses.

**School-Based Interventions.** Vellutino et al. (1996) asked first-grade teachers to nominate their poorest readers at the beginning of the school year. Those who became study participants scored in the lowest 15th percentile on either the Word Attack or Word Identification subtests of the *Woodcock Reading Mastery Test-Revised* (WRMT-R; Woodcock, 1987). These students were then tutored daily for 30 min. over one or two semesters (spring semester in first grade, fall semester in second grade). Instruction was individualized and incorporated phonemic awareness, decoding, sight word practice, comprehension strategies, and reading connected text. No fidelity-of-treatment data were reported.

The students were administered the Word Attack and Word Identification subtests of the WRMT-R five times between winter of first grade and spring of second grade. Students' responsiveness to treatment was based on slopes derived by linear regression analysis. Vellutino et al. (1996) described four levels of treatment responsiveness: "very limited growth," "limited growth," "good growth," and "very good growth." Two thirds of the tutored readers demonstrated "good growth" or "very good growth." They did not perform significantly worse than normal readers after one semester of tutoring. Vellutino et al. suggested that these children were not reading disabled but "instructionally" disabled. By contrast, one third of the tutored readers remained in the lowest 30th percentile on the two subtests of the WRMT-R. These children were termed "difficult-to-remediate."

Vellutino et al. (1996) looked for differences in performance between the groups with very limited growth and very good growth on a broad range of measures administered in the fall of kindergarten and spring of first grade. Three of seven measures that reliably differentiated the two groups reflected phonological processing. The group with very limited growth had significantly lower pretreatment segmentation skills; they had lower scores on tasks measuring phonological retrieval, including rapid automatized naming tasks, and they had lower scores on tasks requiring phonological encoding, such as immediate and delayed recall of abstract words. The remaining four tasks differentiating the two groups were syntactic awareness, visual-verbal learning, counting, and number identification. Each of the tasks required encoding in phonological memory. Vellutino et al. suggested that these results provide further evidence that phonological coding deficits limit the working memory needed for reading development and responsiveness to treatment.

Hatcher and Hulme (1999) reanalyzed data from a prior study (Hatcher, Hulme, & Ellis, 1994) to describe predictors of children's responsiveness to treatment as measured by their gains in reading accuracy and comprehension. Their study compared the effects of three interventions (reading, phonology, or reading and phonology) on reading achievement. Participants were British 7-year-olds with reading scores in the lowest 15th percentile. They were tutored by teachers (not their own) over 20 weeks in forty 30-min. sessions. Hatcher et al. (1994) reported that the teachers followed lesson protocols, but they did not report fidelity-of-treatment data.

Prior to the intervention, students were tested on measures of cognition (intelligence, picture naming, arithmetic, recall of visual designs), reading (context-free word recognition tasks and reading passages with comprehension questions), and phonological skills (nonword repetition, phoneme deletion, phoneme blending, nonword segmentation, sound categorization, and digit recall). Hatcher and Hulme (1999) factor analyzed these measures, reducing them to a set of five: phoneme manipulation, rhyme, verbal ability, nonverbal ability, and phonological memory. The authors then used these factors to predict posttreatment reading accuracy and reading comprehension scores in a series of hierarchical regressions.

Treatment group and phoneme manipulation were unique predictors of growth in reading accuracy. The importance of phoneme manipulation held in separate analyses conducted for the reading-only and reading and phonology groups but not for the phonology-only group. Treatment group and phoneme manipulation were also predictors of growth in reading comprehension, as was verbal ability. By contrast, nonverbal ability, phonological memory, and rhyme were not important predictors of reading accuracy or comprehension.

**Clinic-Based Interventions.** Two studies were conducted in university clinics. Uhry and Shepherd's (1997) 12 participants were middle class, mostly Caucasian, attending first or second grade, and obtaining reading instruction in special education resource rooms. All but three had a family member who had been diagnosed with dyslexia. Students were selected who met three criteria: a Full Scale IQ of 90 or higher, a discrepancy of two standard deviations or greater between IQ and sightword reading on the WRMT-R, and an unspecified "low" pretreatment score on phonological awareness, rapid naming, or verbal short-term memory. Students' IQ scores ranged from 106 to 130, with a mean of 116.8. Nine students displayed delayed phonological retrieval indicated by slow serial naming times; 11 had poor short-term memory indicated by an apparent difficulty remembering words out of context.

Students were tutored individually twice per week in 1-hour sessions for 5 months. Training incorporated letter-sound correspondence through use of phonetic patterns (5 min.), phonological awareness by means of a segmentation

and spelling activity involving letter tiles (5 min.), multisensory writing techniques (5 min.), guided reading in phonetically patterned text (5 min.), shared reading in pattern books (25 min.), and guided writing with invented spelling (15 min.).

Uhry and Shepherd (1997) described only one student as unresponsive to treatment, although they did not define unresponsiveness. They suggested that the severity of this student's naming deficits (6 *SD* below age norms in rapid color naming, 3 *SD* below in rapid letter naming) and her attention deficit limited her ability to generalize phonological awareness to automatic word recognition through either decoding or sight word strategies. This student was the only study participant whose pretreatment scores were higher on recall of words than on recall of words in a sentence, suggesting that the structure or syntax of sentences did not help her encode phonological information.

Berninger et al. (1999) also conducted a clinical investigation, which explored student responsiveness to three word-recognition treatments (whole word, phonemic decoding, or a combination of whole word and phonemic decoding). Participants were second graders who were referred by their first-grade teachers because of reading problems. On average, their scores were below normative means by 2 *SD* on rapid automatized naming (RAN), 1 *SD* on phonological awareness, and .5 to 1 *SD* on orthographic processing. In the phonemic decoding instruction, students were taught the same words that were presented in the whole-word instruction, but the words were segmented into either single or multiletter spelling units and each unit was presented in a different color. Students received eight 30-min. tutorial sessions from graduate students. No fidelity-of-treatment data were reported.

*Unresponsiveness to treatment* was defined by the authors in terms of "slopes not reliably different from zero." Across the three treatments, the percentage of unresponsive students was 45.8% on the taught-word measure and 62.5% and 75% on the Word Attack and Word Identification subtests of the WRMT-R, respectively.

Students who failed to demonstrate progress on the taught-word measure scored lower on a composite of orthographic measures (two word and letter recall tasks), a phonological composite (phonemic deletion and segmentation), verbal IQ, and RAN tasks. Students who made no growth on the Word Attack subtest scored lower only on RAN tasks. Students who made no growth on the Word Identification subtest scored lower on verbal IQ, the phonological composite, and RAN tasks. The investigators reported that only low RAN performance was a common characteristic of children who made no growth on all three (taught-words, Word Attack, and Word Identification) measures.

### **Studies of Treatment Effectiveness**

**Beginning Readers Without Disabilities.** Four studies examined treatment effects for beginning readers without dis-

abilities (i.e., Ehri & Robbins, 1992; Fox & Routh, 1976; Petersen & Haines, 1992; Vandervelden & Siegel, 1997). Students ranged in age from 4 to 7 years. Most students attended middle class schools. Only Vandervelden and Siegel's participants attended inner-city, high-poverty schools, and one third of them spoke English as a second language.

In each of the four studies, treatments included decoding training by analogy, which attempts to help students recognize shared phonograms in words like *cat* and *bat*. Treatments ranged from 1 to 6 hours in duration, and they were conducted by research staff members, rather than by the children's classroom teachers. All researchers but Vandervelden and Siegel (1997) reported positive treatment effects on various reading measures.

Among the four studies, nonresponders differed from responders in terms of their difficulty in segmenting at the phoneme level. Ehri and Robbins (1992), for example, found through posttreatment error analysis that nonresponders did not attempt to decode words phonetically but guessed from the list of words they had been taught during treatment. Given the nonresponders difficulty in segmenting words, it may not be surprising that they would be unaware of the shared phonogram in words such as *cat* and *bat* and that they did not benefit from analogy training.

**Preliterate Children with Disabilities.** Authors of four of five studies (Fazio, 1997; Kasten, 1998; O'Connor et al., 1996, 1998) included preliterate children with and without disabilities. The remaining investigation (O'Connor et al., 1993) focused solely on children with disabilities. Among these five studies, students' ages ranged from 4 to 7 years. Their disabilities included speech and language delays (Fazio, 1997) and developmental delays (Kasten, 1998; O'Connor et al., 1993; O'Connor et al., 1996, 1998). Fazio's multisensory phonological encoding training lasted for 1 hour, whereas Kasten's resource room phonics instruction ran for 3 years. In three studies (O'Connor et al., 1993; O'Connor et al., 1996, 1998), students were trained in phonological awareness. In the first of these, O'Connor et al.'s (1993) research staff taught preschoolers in small groups; in the later two studies, classroom teachers taught the kindergarten participants. Results from four of these five studies (all but Kasten's) support the efficacy of early phonological intervention for a majority of young students with relatively severe disabilities.

Despite the overall success of this early intervention, as many as 50% of students with disabilities were unresponsive to treatment. Among O'Connor et al.'s (1993) preschool participants, more were unresponsive to segmenting training (46%) than to blending training (36%) or to rhyming training (8%). In O'Connor et al.'s (1996) investigation, students with disabilities were less responsive (i.e., made less than half the average gain) than repeating kindergartners or nondisabled peers. These unresponsive students included 1 of 2 children with behavior disabilities, 6 of 9 students with mild mental retardation, and 5 of 13 students with learning disabilities.

However, according to the researchers, type of disability and type of classroom placement did not seem to mediate findings. Thus, although researchers have reported that in general preliterate children with disabilities are more likely than nondisabled peers to be unresponsive, it is unclear what additional child (or school or treatment) characteristics may mediate responsiveness to treatment.

**Older Children with Reading Disabilities.** Older students in six studies were selected by investigators because they had reading difficulties. Students ranged in age from 7 to 9 years. All researchers but Hurford (1990) included students from culturally diverse and high-poverty schools. Foorman et al.'s (1997) students and Snider's (1997) students were in resource rooms and met their schools' discrepancy criteria for a learning disability in reading. Across the studies, treatments varied widely in terms of focus, duration, and who implemented them. Hurford conducted computer training in phonemic discrimination. Snider used Reading Mastery for Direct Instruction. Vadasy et al.'s (1997) relatively complex training included instruction in letter-sounds, phonological awareness, word analogy training, spelling, and reading connected text. The remaining three investigators each compared effects of different treatments: O'Shaughnessy and Swanson (2000) contrasted phonological awareness training to decoding by analogy training; Foorman et al. (1997) compared effects of synthetic phonics, analytic phonics, or sight word instruction; and Foorman et al. (1998) evaluated the effects of direct code, embedded code, and implicit code curricula.

Classroom teachers conducted the treatments in Snider's (1997) study and in both investigations by Foorman and associates (1997, 1998). O'Shaughnessy and Swanson (2000) used paraprofessionals, and Vadasy et al. (1997) relied on community volunteers to implement treatment sessions. Hurford's (1990) intervention was computer-based, and research staff members taught students how to use the program.

Whereas the duration of Hurford's (1990) computer-assisted treatment was a only 2 hours, the length of treatments in the other studies ranged from 100 after-school lessons in Vadasy et al.'s (1997) investigation to the entire school year in the three studies implemented in students' classrooms (Snider, 1997; Foorman et al., 1997; Foorman et al., 1998). In terms of treatment intensity, only Vadasy et al. used tutorials. Snider's and Foorman et al.'s (1997) treatments were conducted in resource rooms settings, whereas Foorman et al. (1998) combined pull-out and small-group work with whole-class instruction. Investigators of all six studies reported positive effects for their respective treatments.

Researchers reported various degrees of student unresponsiveness, although they differed in their definitions of this term. In two studies, for example, investigators set absolute criteria. Foorman et al. (1998) specified unsatisfactory growth as less than 2.5 words per min. over the year. Fewer students were unresponsive in the direct code treatment

(16%) than in the embedded code (44%) or implicit code (38% and 46%, respectively, for researcher-aided and non-researcher-aided) treatments. Vadasy et al. (1997) specified unsatisfactory growth as less than 8 points on the reading and spelling subtests of the WRAT-R, and 35% of students met that criterion. Two investigations defined unresponsiveness in terms of rate and accuracy of performance on oral reading fluency measures: Snider (1997) reported 10% unresponsiveness; O'Shaughnessy and Swanson (2000) found more unresponsive students in word analogy training (27%) than in phonological awareness training (20%). Hurford (1990) defined unresponsiveness as posttreatment segmentation scores less than those of students without disabilities, but Hurford did not report a percentage of unresponsiveness. Foorman et al. (1997) analyzed predictors of growth in phonological processing and reading, but, like Hurford, they did not report on the number of nonresponders, nor did they define unresponsiveness.

Across these studies, a variety of child characteristics were associated with unresponsiveness: low verbal ability, minority status, and poor segmentation and spelling skills (Foorman et al., 1997); weak word-identification skill (O'Shaughnessy & Swanson, 2000); attention problems (Snider, 1997; Vadasy et al., 1997); and poor phonemic discrimination (Hurford, 1990).

## DISCUSSION

Findings from the 23 studies indicated that early literacy interventions helped most students, including many students with disabilities. However, depending on the individual study and outcome measure, between 8% and 80% of students made little or no improvement. A majority of unresponsive students demonstrated poor phonological awareness. Additional characteristics were also correlated with student unresponsiveness (see Table 3).

### *Characteristics Associated with Unresponsiveness*

**Phonological Awareness.** Authors of 21 of the 23 studies explored the importance of phonological awareness. In 16 of the 21 studies, researchers reported that poor phonological awareness clearly characterized unresponsive students. Its importance was less clear in four other studies. Foorman et al. (1998) and Hatcher and Hulme (1999), for example, found that an initial level of phonological skill was predictive of treatment outcomes only if phonological or decoding training was implicitly, rather than explicitly, delivered. Schneider et al. (1999) and Torgesen and Davis (1996) determined that alliteration and invented spelling were better predictors than phonological awareness. Only O'Shaughnessy and Swanson (2000) searched for and failed to find a relationship between initial phonological skill and reading development. Researchers in just 2 of the 23 studies (Kasten, 1998; Snider, 1997) did not explore whether low initial phonological skill was related

**TABLE 3. Number of Studies in Which Learner Characteristics Were Significantly Associated with Nonresponding Students**

Findings	Phonological awareness (n = 21)	Phonological memory (n = 7)	Rapid naming (n = 7)	IQ (n = 15)	Attention (n = 9)	Orthography or spelling (n = 7)	Demographics (n = 4)
Yes <sup>a</sup>	16	4	5	5	7	3	2
No <sup>b</sup>	1	2	1	7	2	4	0
Mixed <sup>c</sup>	4	1	1	3	0	0	2

Note. Total number of studies = 23. The “phonological awareness” column should be read this way: In 16 of 21 studies exploring the importance of phonological awareness to treatment nonresponsiveness, a statistically significant relationship was obtained; in one study, the relationship was nonsignificant; in four studies, results were mixed; and in two studies (23 – 21 = 2), the researchers did not explore the relationship.

<sup>a</sup>Statistically significant relationship. <sup>b</sup>Nonsignificant relationship. <sup>c</sup>Combination of significant and nonsignificant relationships.

to treatment unresponsiveness. Because Snider’s and Kasten’s unresponsive students had cognitive delays and received speech therapy, it is reasonable to assume these students had low phonological skills.

**Phonological Encoding in Memory and Phonological Discrimination.** In six of nine studies using measures of phonological encoding (Fazio, 1997; Schneider et al., 1999; Torgesen et al., 1999; Uhry & Shepherd, 1997; Vellutino et al., 2000; Vellutino et al., 1996), unresponsive students had difficulty encoding, storing, and organizing phonological information in working memory. By contrast, Hatcher and Hulme (1999), O’Shaughnessy and Swanson (2000), and Torgesen and Davis (1996) failed to find such a relationship. In a different vein, only Hurford (1990) examined children’s ability to discriminate between sounds in words. Findings suggested that discriminative difficulty may impede children’s acquisition of segmentation skills.

**Rapid Naming.** Authors of six of seven studies exploring the importance of rapid naming reported that many students who were unresponsive to treatment were distinguished by slow naming speed (Berninger et al., 1999; Torgesen & Davis, 1996; Torgesen et al., 1999; Uhry & Shepherd, 1997; Vellutino et al., 2000; Vellutino et al., 1996). As mentioned, Uhry and Shepherd found one student’s naming speed performance to be 6 *SD* slower than peers with reading disabilities. These findings seem consistent with the “dual-deficit hypothesis” (Wolf, 1991; Wolf & Bowers, 1999), which suggests that children with deficits in phonological awareness and phonological retrieval are more impaired in reading than children with only one type of deficit. However, it may be important to note that Hatcher and Hulme (1999) did not find a connection between rapid naming and treatment responsiveness. In addition, Schneider et al. (1999) obtained a relationship between rapid naming and treatment responsiveness for students with average phonological awareness but not for students with low- or above-average phonological awareness.

**Intelligence, Verbal IQ, and Disability Status.** Five groups of researchers (Berninger et al., 1999; Fazio, 1997; Foorman et al., 1998; O’Connor et al., 1993; Torgesen & Davis, 1996) reported that children with low IQ or low verbal ability made less progress in phonological or reading development. On the other hand, seven research teams (Hatcher & Hulme, 1999; O’Shaughnessy & Swanson, 2000; Schneider et al., 1999; Torgesen et al., 1999; Vadasy et al., 1997; Vellutino et al., 2000; Vellutino et al., 1996) found no statistically significant relationship between intelligence and treatment unresponsiveness. Vellutino et al. (1996) assessed a wide range of linguistic abilities and found that only syntax and the recall of abstract words differentiated children who made little growth in reading. These researchers suggested that both measures were more related to phonological memory than to general verbal ability or to vocabulary. Similarly, Torgesen et al. noted that verbal ability was not associated with treatment unresponsiveness once phonological skill and socioeconomic status were entered into a regression equation.

All five investigations that included students with developmental delays (Kasten, 1998; O’Connor et al., 1993; O’Connor et al., 1996, 1998; Snider, 1997) reported high frequencies of unresponsiveness. Children with developmental disabilities often experience language deficits. However, the language ability of students in these studies was not reported. Therefore, it is impossible to know whether treatment unresponsiveness was related specifically to low verbal ability or to a more general developmental disability.

**Attention and Behavior Problems.** Seven groups of investigators found a relationship between attention deficits or behavioral problems and unresponsiveness (O’Shaughnessy & Swanson, 2000; Snider, 1997; Torgesen et al., 1999; Uhry & Shepherd, 1997; Vadasy et al., 1997; Vellutino et al., 2000; Vellutino et al., 1996). Specifically, Torgesen et al. and Vadasy et al. reported that even in individual tutorial sessions attention and conduct problems prevented many children from benefiting from treatment. Foorman et al. (1997) also

reported behavior problems in their sample but only in children who came from a “tough” school.

**Orthographic Processing.** Seven studies evaluated orthographic skills and invented spelling. Only three reported that the inability to recall a letter or word presented visually was associated with unresponsiveness (Berninger et al., 1999; Foorman et al., 1997; Torgesen & Davis, 1996).

**Demographics.** Five studies analyzed whether children’s demographics mediated responsiveness to treatment. Children’s age (Foorman et al., 1998; Hurford, 1990), parents’ education and occupation (Torgesen et al., 1999), and children’s level of English proficiency (Vandervelden & Siegel, 1997) have all been found to correlate with treatment unresponsiveness. In addition, Foorman et al. found that minority children had more difficulty than nonminority peers learning to segment and spell, which was related to lower phonological but not reading outcomes.

**Summary.** Seven child characteristics have been associated with treatment unresponsiveness: phonological awareness, phonological memory, rapid naming, intelligence, attention or behavior, orthographic processing, and demographics. All but two teams of investigators explored the relationship between phonological awareness and treatment unresponsiveness, and in 70% of the studies phonological awareness was found to be a clear and important correlate. The importance of intelligence to treatment responsiveness is less clear: 22% of researchers reported a relationship, but 30% did not. The connections between the remaining five characteristics and treatment unresponsiveness have been explored infrequently. Sixty-one percent of research teams did not address the importance of phonological memory, 70% did not explore rapid naming, 61% did not explore attention or behavior, 70% did not explore orthographic processing, and 80% did not explore demographics (see Table 3). Not one study provided a direct test of the dual (or multiple) deficit hypothesis, which posits that students with combined deficits are more likely to be unresponsive than students with a single deficit. Thus, although there is suggestive evidence of the importance of this last set of characteristics, future research is obviously needed.

### **Methodological Issues**

Comparing characteristics of treatment nonresponders across studies is anything but straightforward. There are several reasons for this. First, as displayed in Table 2, researchers used different definitions of unresponsiveness. Torgesen et al. (1999) employed standard scores below 85 on subtests of the WRMT-R. Defining unresponsiveness in terms of performance level may have an important drawback, especially for very low performing students because performance level is

insensitive to students’ growth. O’Connor et al. (1996, 1998), on the other hand, defined unresponsiveness as growth of less than half the mean gain of treatment students. Defining unresponsiveness exclusively in terms of growth may also be problematic: Higher performing students may show little growth but demonstrate acceptable performance levels; lower performing students, including many with disabilities, may make relatively impressive growth but have unacceptably low performance levels.

A second concern is that participants across the studies were a heterogeneous group. Five investigations (Foorman et al., 1997; Hurford, 1990; O’Shaughnessy & Swanson, 2000; Snider, 1997; Uhry & Shepherd, 1997) included students with reading disabilities. Five additional studies included children with speech and language impairments (Fazio, 1997), cognitive delays, or behavior disorders (Kasten, 1998; O’Connor, et al., 1993; O’Connor et al., 1996, 1998). Further, researchers’ “cut-scores” ranged from the lowest 35th percentile to the lowest 10th percentile of the distribution on either reading or phonological awareness outcomes. Moreover, these percentiles were based on study samples, not on normative populations. Thus, the lowest 10th percentile from the respective samples of two studies could define different groups of children.

Third, treatments varied from one investigation to another along a number of dimensions, including duration, intensity, and background of trainers (see Table 1). In seven studies, treatments were brief (1–9 hours); in seven additional investigations, the duration was longer (20–55 hours); and in 5 studies, treatments ran for more than 80 hours (up to 3 years). Although more than half of the investigators conducted one-to-one tutorials, researchers in five studies used small groups (Fazio, 1997; O’Connor et al., 1993; O’Shaughnessy & Swanson, 2000; Torgesen & Davis, 1996; Vandervelden & Siegel, 1997) and, in six studies, they used whole-classroom formats (Foorman et al., 1997; Kasten, 1998; O’Connor et al., 1996, 1998; Schneider et al., 1999; Snider, 1997). Whereas most trainers were graduate students or research staff members, O’Shaughnessy and Swanson depended on paraprofessionals, and Vadasy et al. (1997) used community volunteers. In four studies (Foorman et al., 1997; O’Connor et al., 1996; Kasten, 1998; Snider, 1997) special educators conducted the treatments; general educators conducted the treatment in only one study (Schneider et al., 1999). This variation in treatment-related characteristics necessarily complicates interpretations of the studies as a group. We can not dismiss the possibility that treatment unresponsiveness may be related to treatment duration, treatment intensity, or the background or skill of the trainers rather than to the characteristics of unresponsive students.

In a similar vein, only 1 of the 23 studies reported fidelity-of-treatment data (see Table 1). Without this information, we cannot assume that treatments were responsible for the observed positive change in reading behavior. If a majority of study participants improve their reading performance in

the absence of fidelity-of-treatment data, something other than the treatment may be responsible, which would suggest that unresponsive students may be failing to respond to something other than the treatment.

### **Implications for Research and Practice**

**Research.** We offer several suggestions for future research on children who are unresponsive to generally effective beginning reading instruction. First, researchers should try to agree on a common definition of the construct *treatment unresponsiveness*. None emerged from this review. A preferable definition would be based on a broadly acceptable, absolute criterion for reading success. Good, Simmons, and Smith (1998), for example, have argued that an oral reading fluency rate of less than 40 words per min. at the end of first grade might be viewed as an important marker of unresponsiveness. Torgesen (2000) suggested that until such an absolute criterion has been validated by additional research, the definition of unresponsiveness should be standard scores below the 30th percentile on recognized normative reading tests. Although Torgesen's and Good et al.'s approaches seem reasonable enough, they have limited application for preschool and kindergarten populations because these groups are typically not yet reading. In addition, the approaches may be unrealistic for many students with moderate or severe disabilities. They may also be entirely irrelevant when we consider other domains, such as writing.

Second, as indicated, many potentially important characteristics in connection with unresponsiveness to early reading instruction, such as phonological memory, have been measured infrequently or not at all. Similarly, because many studies deliberately excluded students with low IQ scores, the relationship between intelligence and unresponsiveness has been studied insufficiently. Third, future investigations should identify and describe the trainers, including information about the preparation they received and the fidelity with which they implemented the treatment. Moats and Lyon (1996) described how trainer characteristics may influence children's responsiveness to treatment; fidelity-of-treatment information would strengthen confidence that variation in responsiveness was not merely a reflection of differences in the accuracy of treatment implementation.

Fourth, as researchers become more informed about learner characteristics associated with nonresponders, they may wish to revisit the challenge of trying to identify aptitude-treatment interactions (ATIs), that is, specifying interventions that differentially affect children with particular strengths and weaknesses. In principle, the discovery of ATIs should engender more effective and efficient teaching and learning. However, our review of the nonresponder literature suggests that it may be difficult to characterize a "typical" nonresponder because (a) she or he is likely to have a relatively complex profile of strengths and weaknesses and (b) her or his learner profile will probably be different from that of other nonre-

sponders (Berninger et al., 1999; Foorman et al., 1997; Torgesen et al., 1997). In short, as research on treatment nonresponsiveness continues, we anticipate that unresponsive students will be characterized by considerable intra- and interindividual variation, which would seem to defy precise applications of treatments to learner strengths and weaknesses.

Alternatively, researchers can develop deliberately complex multicomponent interventions that in principle provide something for every struggling reader. An example of this approach is RAVE-O (retrieval, automaticity, vocabulary elaboration, and orthography; Wolf, Miller, & Donnelly, 2000), a comprehensive reading fluency program that spans phonological awareness, orthographic pattern recognition, metacognitive strategies for word retrieval, and semantic development. An apparent disadvantage of RAVE-O and similar multidimensional programs is that they may prove difficult for teachers to implement.

**Practice.** Several teams of researchers (e.g., McMaster, Fuchs, Fuchs, & Compton, in press; O'Connor, 2000; Simmons et al., as cited in Coyne, Kame'enui, & Simmons, 2001) are currently exploring ways to make multicomponent programs more practical by reorganizing them into sequential phases. In Phase 1 ("primary intervention"), one or two of these programs' basic components are implemented by general educators in mainstream classrooms with the expectation that these components will accelerate the learning of most children. Phase 2 ("secondary intervention") involves only those children unresponsive to Phase 1 instruction. In Phase 2, additional instructional components are brought to bear with perhaps greater frequency and for longer duration than in the prior phase. Because of its comparative complexity and intensity, Phase 2 instruction is conducted by someone other than the classroom teacher and typically in small student groups.

As we write, the Bush administration is advancing this two-phase (or "two-tier" or "layered") approach to identifying children with learning disabilities. Rather than rely on an IQ-achievement discrepancy to identify these students, school personnel would employ this identification process, requiring children to demonstrate unresponsiveness to both primary and secondary interventions before they are considered eligible for special education.

The careful study of children who are unresponsive to generally effective treatment is a relatively new area of research. Not surprising, there are definitional and methodological challenges associated with it. Nevertheless, this line of inquiry has potential to help researchers and practitioners identify young children at risk for reading failure and develop more effective instruction in general and special education. The extant database, albeit small and imperfect, is informed and imaginative and points the way for future work, which should be pursued if we, as a field, are serious about leaving no child behind. ■

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## AUTHORS' NOTES

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## NOTE

Adding an asterisk to these terms will allow the database to be searched for words containing that root (e.g., *phon\** will pull up "phoneme," "phonological," etc.).

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