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Growth in early reading skills from kindergarten to third grade

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Abstract

We examined models of individual change and correlates of change in the growth of reading skills in a sample of 40 children from kindergarten through third grade. A broad range of correlates was examined and included family literacy, oral language, emergent reading, intelligence, spelling, and demographic variables. Individual growth curve analysis was used to model change in Letter Word Identification (LWID), Word Attack (WA), and Passage Comprehension (PC) subtests of the Woodcock–Johnson Psychoeducational Battery – Revised. Third grade LWID was predicted uniquely by family literacy, phonological awareness, and emergent reading skills. Growth in LWID was predicted uniquely by emergent reading skills. Phonological awareness, spelling, and emergent reading were unique predictors of third grade WA, whereas family literacy and emergent reading skills uniquely predicted third grade PC. The general oral language factor defined by semantic and syntactic variables did not contribute significant unique variance in any of the models. Thus, the pattern of results extends the model of emergent-to-conventional literacy proposed by Whitehurst and Lonigan (1998) to third grade and suggests that early contextual understandings necessary for competent reading (family literacy and emergent reading) become more influential as reading skills develop.

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1. Introduction

The process of learning to read has received unprecedented attention over the last decade culminating in two national-level reviews (Snow, Burns, & Griffin, 1998; National Reading Panel, 2000). These reviews point out that while a great deal of progress has been made in understanding correlates of reading and instructional factors, a number of questions remain. One issue that deserves fuller treatment is the characterization of normal growth in early reading and the identification of variables that predict growth. The purpose of the present study was to examine patterns of growth in several reading skills in children from kindergarten to third grade and to examine the relative strength of a constellation of theoretically relevant predictors. Although there is no shortage of studies that examine early predictors of later reading achievement, refinements in conceptual models and methodological advancements provide avenues for improved work in this area.

1.1. Conceptual issues

Scarborough (1998) noted that a weakness in the prediction literature is the failure to view reading achievement from a multivariate perspective. Many variables demonstrate respectable univariate relationships with reading achievement, but it is impossible to determine the relative importance of any specific variable if it is not compared against plausible rivals. A related point is the uneven attention given by researchers to relevant control variables (Roth, Speece, Cooper, & DeLaPaz, 1996). The exclusion or inclusion of control variables can result in vastly different interpretations of results. For example, Bryant, MacLean, and Bradley (1990) demonstrated that inclusion of intelligence (IQ) and sociodemographic variables substantially reduced the relationship between linguistic and literacy variables. Similarly, the unique contribution made by oral language variables to reading comprehension was reduced from 13.8% to 3.6% when IQ was added as a control variable (Catts, Fey, Zhang, & Tomblin, 1999).

The need for a multivariate perspective and inclusion of control variables raises the issue of which variables should be included in a study of early reading growth. The current investigation was designed to take a broad view of potential domains in an attempt to capture theoretically relevant sources of variance. In addition to background variables suggested in the previous paragraph (SES, IQ), we included measures of family literacy, oral language (phonological awareness, listening comprehension, semantics, syntax and morphology), spelling, and emergent reading (concepts of print, alphabetic knowledge, construction of meaning). These variables, assessed in kindergarten, were used to predict individual growth in reading skills over four years as well as to predict end point status at third grade.

These variables are frequently represented in the prediction and intervention literature with young children; however, they are not studied in concert (Catts et al., 1999; Foorman, Francis, Novy, & Liberman, 1991; Fuchs et al., 2001; Lonigan, Burgess, & Anthony, 2000; Scarborough, 1998; Snow, Tabors, Nicholson, & Kurland, 1995; Torgesen et al., 1999; Wagner et al., 1997). Home literacy and language skills perhaps have the most uneven relationship with early reading in that there is evidence both for and against an important role for these variables. Scarborough (1998) concluded that, overall, home literacy variables have at best a weak relationship with later reading, but noted there are some authors who report stronger relationships. For example, Griffin and Morrison (1997) found a small but significant contribution to second grade children's reading recognition scores from a kindergarten measure of family literacy. Using the same instrument, but this time in a structural equation model, Christian, Morrison, and Bryant (1998) controlled for a wide variety of variables. They found that family literacy demonstrated a causal influence on reading variables but not mathematics measures in kindergarten. Kindergarten children's experiences with books and stories at home were predictive of level of book reading attained in second grade (Weinberger, 1996). Finally, program evaluation studies demonstrated that preschool family literacy intervention programs are modestly successful in boosting children's literacy achievement in school (Hayes, 1997).

Although the connection between phonological awareness and word decoding is unambiguous, the role of other language variables is less clear. It is generally believed that reading is a language-based skill (Aram & Nation, 1980; Bashir & Scavuzzo, 1992; Bishop & Adams, 1990), but there are data that challenge the role of language variables beyond the potent contribution of phonemic awareness ability. For example, Vellutino et al. (1996) identified few oral language differences between groups of poor readers who responded differentially to reading intervention on a battery that included semantic, syntactic, and general language measures. Similarly, Morris et al. (1998) did not find substantial oral language differences between subtypes of children with reading disability. They included measures of morphological awareness, semantics, and syntax.

Spelling and early reading skills (e.g., letter name and sound knowledge) have a more consistent and compelling relationship with later reading given that they map directly onto skills required for successful reading. Spelling often is included as a component of successful early reading interventions (Ball & Blachman, 1991; Fuchs et al., 2001; Tangel & Blachman, 1992), and early reading skills account for substantial proportions of variance in later reading skills (Foorman et al., 1991; Wagner et al., 1997).

Whitehurst and Lonigan (1998) presented a conceptual model of mechanisms thought to promote the transition between emergent and conventional literacy and that encompassed the variables selected for this study. They suggested that two types of processes were necessary to understand literacy development: "inside-out" and "outside-in." Inside-out skills are those that can be accomplished without reference to a context. Phonemic awareness, letter sounds, and spelling are representative of this type of skill in that meaning or contextual knowledge is not required for success in task completion. Outside-in skills require contextual understanding and include semantic, narrative and other oral language skills to promote comprehension. Whitehurst and Lonigan stated "Outside-in and inside-out processes are both essential to reading and work simultaneously in readers who are reading well" (p. 855).

In the current study, phonological awareness and spelling constituted inside-out skills. Outside-in skills were family literacy and the oral language variables other than phonological awareness. The measure of emergent reading captured both types of variables because the total score used in analysis included alphabetic skills (inside-out) and conventions of print and construction of meaning (outside-in). Whitehurst and Lonigan demonstrated that from preschool to second grade, inside-out skills (linguistic awareness, letter knowledge, emergent writing) had a large and significant effect on conventional literacy in first and second grade. Outside-in skills (receptive and expressive vocabulary) did not have a significant effect until second grade, and even then it was of modest magnitude. The authors speculated "language skills may not have their most significant role in reading achievement until second or third grade" (p. 863).

This model can be used to make predictions for the current data set. Because our use of the model is post hoc, the analyses and results should be viewed as exploratory. Based on Whitehurst and Lonigan's (1998) initial analysis, we would expect inside-out skills to maintain a strong relationship to both the growth and reading outcomes at third grade. However, outside-in skills, specifically oral language, should exert greater influence on reading comprehension than previously obtained in earlier grades. Also, according to Whitehurst and Lonigan, family literacy should not be a predictor of growth or third grade reading because its direct effect in their study was on language development, not reading.

We have shown in previous work how complex the language-reading relationship may be, in that reliance upon phonological awareness as the predominant predictor of reading underestimates the role of other language variables (Cooper, Roth, Speece, & Schatschneider, 2002; Roth, Speece, & Cooper, 2002; Speece, Roth, Cooper, & De La Paz, 1999). In Speece et al. (1999), we were able to demonstrate that first grade reading attainment was differentially related to subtypes of children formed by a multivariate language battery. Phonological awareness was one but not the only variable that contributed to the differentiation of the subtypes. In Roth et al. (2002), the tests of hierarchical regression models revealed that second graders' reading *comprehension* was not predicted by phonological awareness, but was predicted by structural language skills (i.e., semantics) as well as word retrieval (confrontation naming).

1.2. Methodological perspective

Many of the studies discussed to this point were based on a regression strategy in which variables measured in kindergarten were used to predict reading outcomes. What is less frequently studied is the variation in growth over time in which all data points, rather than two used for regression, are used to model individual change and correlates of change. An individual growth curve approach "focuses the study of change on interindividual differences in intraindividual change" (Francis, Fletcher, Steubing, Davidson, & Thompson, 1991, p. 30). Not only is change viewed as a property of individuals rather than groups, it also is viewed as a continuous process rather than an incremental approach (e.g., multiple regression) (Francis et al., 1991).

By describing the parameters of reading skill growth, we gain some understanding of developmental patterns not possible with strictly linear approaches. The analysis of growth parameters provides insight not only to more precise endpoint (intercept) prediction but also to the process of change.

Torgesen et al. (1999) used growth curve analysis to examine reading growth in an at-risk group of children identified in kindergarten and followed to second grade. They examined growth and predictors of growth for word attack and word identification skills. Linear models were not adequate to describe growth in these variables, requiring a parameter that represented slowing of progress over time. Both models were symmetrical regarding unique predictors of second grade reading and growth: phonological awareness, SES, and teacher ratings of behavior.

From the perspective of the model proposed by Whitehurst and Lonigan (1998), Torgesen et al.'s results did not support the model. Although "outside-in" variables were in the models (home literacy and general verbal ability), these variables did not make a unique contribution to word recognition. However, in a regression analysis, general verbal ability was a unique predictor of second grade passage comprehension but only when SES was not in the regression model.

The Torgesen et al. (1999) study is one example of a growing number of investigations using growth curve analysis to examine reading development (e.g., Compton, 2000; Foorman, Francis, Mehta, Schatschneider, & Fletcher, 1997; Stage, Sheppard, Davidson, & Browning, 2001) The purpose of the present study was to apply the methods of growth curve analysis to explore further several conceptual issues related to early reading. First, how is growth in reading best characterized from kindergarten to grade 3? Do children progress at a linear rate or does growth accelerate or decelerate over this period of development? Second, which oral language, reading, and background variables, individually and conditionally, best predict growth and third grade reading? This mulitivariate approach may clarify the relative strength of theoretically important variables. Third, does the conceptual framework proposed by Whitehurst and Lonigan assist in explaining the pattern of significant correlates of reading growth and reading outcomes? This study represents the final year of a four-year longitudinal investigation of oral language and reading (Cooper et al., 2002; Roth et al., 2002; Speece et al., 1999).

2. Method

2.1. Participants

The children who participated in this study attended a public elementary school in the Mid-Atlantic states. The initial sample for the kindergarten analysis consisted of 88 children from a population of 109. Reasons for attrition included parents' refusal, children's refusal, and limited English proficiency. Of this sample, 40 children were located for follow-up testing in third grade. The study sample was diverse economically (42% received free/reduced lunch) and racially (38% African-American, 12% Asian, 10% Latino, and 40% White). The mean age of the children at the time of kindergarten testing was 5 years, 6 months (range: 5–2 to 6–3). There were 26 boys (65%) and 14 girls (35%) in the sample. According to school records, the primary language of 11 (28%) of the children was a language other than English. To ensure that only children who understood the test directions were included in the study, children were dropped from the sample if their primary language was not English and they earned extremely low scores on two language measures, PPVT-R and TOLD-P:2 (described below). We included Primary Language as a variable to assess the effects of home language on children's reading growth.

No significant differences were found between the original kindergarten sample and the sample remaining after third grade attrition with respect to gender, SES, race, nonverbal intelligence, or the *Test of Early Reading Achievement-2* (TERA-2) score (Reid, Hresko, & Hammill, 1989). The χ^2 analyses were conducted for the nominal variables and *t*-tests were conducted for continuous variables (all *p*-values $> .10$). Thus, our sample size for growth curve analyses was 40 children statistically comparable to the original pool and with complete data from kindergarten through third grade.

2.2. Measures

The materials consisted of four types of measures: oral language (three domains: structural oral language, phonological awareness, and listening comprehension), spelling, reading, and background variables (see Table 1). The measures included both norm-referenced and experimental tasks known to be reliable and valid.

2.2.1. Structural oral language

Structural language was assessed by three measures of semantics (receptive and expressive vocabulary; word retrieval) and two measures of syntax (comprehension and production of morphological and syntactic rules). Receptive single-word vocabulary was assessed by the Peabody Picture Vocabulary Test – Revised (PPVT-R; Dunn & Dunn, 1981). The child identified a picture (when shown a plate of four pictures) that matched an examiner-provided word. Reliability estimates for the PPVT-R range from .67 to .88 (Sattler, 1988).

Word definitions (i.e., expressive vocabulary) was assessed by the Oral Vocabulary subtest of the Test of Language Development – Primary: 2 (TOLD-P:2; Newcomer & Hammill, 1998). This subtest contains 28 items and the child was required to provide an oral definition for an examiner-provided word. Internal consistency reliability estimates for the TOLD-P:2 subtests and total scores range from .80 to .90, and test–retest reliability coefficients range from .74 to .99 at one- and two-week intervals. The authors present criterion-related validity, and coefficients range from .54 to .86 with the Weschler Intelligence Scale for Children, Peabody Picture Vocabulary Test, and the Auditory Discrimination Test. Crocker (1992a) and Westby (1992) reported the authors provide adequate reliability and validity evidence.

Word retrieval was assessed by the Boston Naming Test (Goodglass & Kaplan, 1983). It is a confrontational naming test in which the child was shown and asked to identify a picture. There are 60 items that increase in difficulty. Construct validity

Table 1
Oral language, reading, and background variables in kindergarten

Domain	Test/variable name
Oral language	
Semantics	Peabody Picture Vocabulary Test – Revised
	Test of Language Development – Primary: 2/Oral Vocabulary
	Boston Naming Test
Syntax	Test of Auditory Comprehension of Language – Revised
	Clinical Evaluation of Language Fundamentals – Revised/ Formulated Sentences
Listening comprehension	Del Rio English Story Comprehension Test
Phonological awareness	Elision (Torgesen's task)
	Blending (Torgesen's task)
Reading	
Emergent literacy	Test of Early Reading Ability – 2
Decoding	WJ-R Psychoeducational Battery/LWID
	WJ-R Psychoeducational Battery/WA
Comprehension	WJ-R Psychoeducational Battery/PC
Spelling	Gentry and Gillet (1993)
Background	
Race	Parent report
Gender	Teacher report
SES	Free and reduced lunch
Family literacy	Modified Morrison parent questionnaire
Primary language	Parent report
Nonverbal IQ	Raven Coloured Progressive Matrices

Note. Reading comprehension measures added and oral language measures deleted in grades 1–3. LWID = Letter Word Identification; WA = Word Attack; PC = Passage Comprehension.

is supported by correlations of .74 with the PPVT-R and .68 with first grade word recognition and passage comprehension (Roth et al., 2002).

Syntax was assessed by two measures of comprehension and production of morphological and syntactic rules. Comprehension of morphological and syntactic rules was assessed by the Test of Auditory Comprehension of Language – Revised (TACL-R; Carrow-Woolfolk, 1985). This test includes items that measure the meaning of words and word relationships, grammatical morphemes (e.g., verb tense, noun number), and comprehension of spoken sentences that assess grammatical functions (e.g., interrogative sentences, active and passive voice). The author reports test–retest reliability coefficients of .89–.91 across ages and split-half reliability estimates of .96. According to Hayes (1989) and Bankson (1989), the author reports sufficient evidence of construct, content, and criterion-related validity, and the TACL-R is psychometrically sound.

Production of morphological and syntactic rules was assessed by the Formulated Sentences subtest of the Clinical Evaluation of Language Fundamentals – Revised (CELF-R; Semel, Wiig, & Secord, 1987). The child was presented with a picture and asked to generate a sentence with a given word or words. There are 20 items, and children's responses were scored on a scale ranging from 0 to 3 based on established criteria. According to Crocker (1992b) and Shapiro (1992), the CELF-R has reasonable standardization, reliability (test–retest coefficients in the .70 range and internal consistency estimates range from .49 to .92 across subtests), and criterion-related validity evidenced through moderate correlations with other measures of oral language. All oral language measures and subtests have adequate psychometric characteristics for research purposes (Salvia & Ysseldyke, 1995, 2001).

2.2.2. Phonological awareness

Phonological awareness was assessed by Torgesen's (n.d.) blending and elision tasks that were prepublication versions of the Comprehensive Test of Phonological Processing (Wagner, Torgesen, & Rashotte, 1999). For the phoneme blending task, children were asked to listen carefully as the examiner separately pronounced each sound of a word (e.g., /c/ /a/ /n/). They were then instructed to put the sounds together to say the whole word. There were five practice items and 29 test items that ranged in difficulty from one syllable, two phoneme words to four syllable, eight phoneme words. The phoneme elision tasks (also referred to as sound deletion) required the children to say a word and then to say what the word would be if a specified phoneme(s) was deleted. For example, after repeating the word "bat," the children were asked what word would be left if said without the /b/. There were four practice items and 25 test items consisting of two- to six-phoneme, one- to two-syllable words. Both tasks have adequate internal consistency and predictive validity with reading measures (Wagner, Torgesen, Laughon, Simmons, & Rashotte, 1993; Wagner, Torgesen, & Rashotte, 1994). The raw scores for the elision and blending tasks were summed to provide a single measure of phonological awareness.

2.2.3. Listening comprehension

Listening comprehension was assessed by a measure of literal and inferential story comprehension (adapted from the Del Rio English Story Comprehension Test; San Felipe-Del Rio Consolidated Independent School District, 1975). The construct validity of this measure is supported by a correlation of .56 with second grade reading comprehension (Roth et al., 2002).

2.2.4. Spelling

Children were asked to spell from dictation the first five words from Gentry and Gillet's (1993) spelling list (monster, united, dress, bottom and hiked). The scoring system was based on Tindal and Marston (1990) and awarded points for correct letter sequences within words, not for correct whole words. The number of correct letter sequences equaled the number of letters in the word plus 1 (maximum score = 36). An independent rater rescored 15% of the protocols with a resulting interscorer reliability index of 93%. Marston (1989) reported that evidence of reliability (.73–.97) and criterion validity (.83–.96) across a number of studies is strong.

2.2.5. Reading measures

The Test of Early Reading Ability – 2 (TERA-2; Reid et al., 1989) and the Woodcock–Johnson Psychoeducational Battery – Revised (WJ-R; Woodcock & Johnson,

1989) were administered to assess emergent and conventional reading skills. The TERA-2 is a test of emergent literacy and assesses children's alphabet knowledge, awareness of conventions of print (e.g., page turning, text directionality), and ability to construct meaning from text (e.g., identification of traffic signs, coupons, and other environmental print). The authors report a test–retest reliability coefficient of .89 and internal consistency reliability (coefficient alpha) of .89 for three- to seven-year-old children. A description of construct, content, and criterion-related validity is presented by the authors, including moderate criterion-related validity coefficients with the Basic Schools Skill Inventory and the Test of Reading Comprehension (Beck, 1992; Hiltonsmith, 1992).

The WJ-R reading subtests includes identification of single letters and words (Letter–Word Identification subtest, LWID), the pronunciation of pseudowords (Word Attack subtest, WA), and identification of missing words in a sentence or sentences (Passage Comprehension subtest, PC). Internal consistency reliability estimates for six- and nine-year-old children for subtests range from .88 to .96. The authors present evidence of construct, content, and criterion-related validity. The concurrent criterion-related validity coefficients range from .63 to .85 for nine-year old children with frequently-administered reading achievement batteries (e.g., Kaufman Test of Educational Achievement, Peabody Individual Achievement Test, and Wide Range Achievement Test). Both the TERA-2 and WJ-R reading subtests have adequate psychometric characteristics for research purposes (Salvia & Ysseldyke, 1995, 2001).

2.2.6. Background measures

The background variables consisted of race, gender, SES (as measured by free/reduced lunch), family literacy, primary language spoken by the child, and nonverbal IQ. Information on race, gender, SES, and primary language was gathered from teacher or parental report.

In kindergarten, family literacy was measured by responses to a modified form of a parent questionnaire developed by Morrison and his colleagues (Morrison, McMahon-Griffith, Williamson, & Harway, 1993). The 21-item Family Literacy Questionnaire comprises items that quantify in a single score (maximum score = 36) the presence of literacy artifacts in the home (e.g., children's books, newspapers, magazines, etc.) as well as the parents' efforts to engage the child's participation in literacy activities, (e.g., shared reading, use of the library). Internal consistency reliability (coefficient alpha) is .65 (Jacobsen, 1994). The instrument has moderate predictive criterion-related validity with reading comprehension in first ($r = .50$) and ($r = .58$) second grades (Roth et al., 2002).

Finally, the school provided scores for the Coloured Progressive Matrices (Raven, 1965) as a measure of nonverbal intelligence. School district personnel administered this test in the spring of the kindergarten year. This test assesses a child's ability to recognize and think logically by completing continuous patterns. According to the manual, test–retest reliability estimates are above .80 and internal consistency estimates range from .85 to .90 (cited in Schuhfried, 2003).

2.3. Procedures

In kindergarten, the children were tested in two 1-h sessions. The kindergarten battery consisted of all measures (except the WJ-R PC subtest), and background variables were collected. In first, second and third grades, a single 1-h session was conducted. Children were administered the WJ-R (all subtests) and language measures not reported in this study. Testing occurred between February and April each year.

2.4. Data analyses

2.4.1. Data reduction

The structural oral language variables obtained from the PPVT-R (oral receptive vocabulary), TOLD-R (oral expressive vocabulary), the Boston Naming Test (word retrieval), the TACL-R (total score for comprehension of syntax and morphology), and the CELF-R (expressive morphology and syntax) were subjected to a principal components analysis to reduce these measures to a single variable for entry into growth curve analyses. This procedure is typical in studies with many oral language variables (e.g., Catts et al., 1999). Based on the sample of 40 children, one principal component was extracted with an eigenvalue of 3.26 that accounted for 65% of the variance. The resulting principal component score is referred to subsequently as "general oral language."

2.4.2. Growth curve analysis

Growth curve analysis was used to model growth in each of the following reading measures: LWID, WA, and PC. WJ-R W scores were used in the analyses. The SAS PROC MIXED (SAS Institute, 1999) procedure was used to model growth (Singer, 1998). Measurement intervals were recoded so that the intercepts were set at third grade reading (Francis, Schatschneider, & Carlson, 2000). Thus, the intercept represents the predicted third grade W score.

To determine the best fitting models of growth (unconditional models), multi-staged analyses were performed (Francis et al., 2000). Model parameters were tested sequentially, first examining the fixed effects and then the random effects for intercept, slope, and quadratic parameters, adding parameters as dictated by the previous step. If the fixed effect for a parameter was a significant component of the model, then the effect of allowing that parameter to vary randomly across students was examined. We used $p < .20$ for determining significant random effects because of low power and a desire to capture all possible variance, although our fixed effects were tested at $p < .05$. Examination of residual plots and comparative fit indices was used to examine the overall fit of the model (Francis et al., 2000).

Once adequate models of growth were determined, a second set of analyses examined the correlates of growth (conditional model) for third grade reading performance and growth in reading skills from kindergarten to third grade. In this way, we could ascertain what variables predicted both end of third grade performance and the rate of growth. Kindergarten general oral language, phonological awareness, emergent reading (TERA-2), spelling, and background factors were examined as correlates of intercept and growth. Listening comprehension was examined as a correlate of PC only because it was expected to be theoretically important to PC, but not LWID or WA. All continuous variables were converted to *z* scores prior to analyses.

A two-step strategy for the conditional model was used (Compton, 2000). First, each variable was examined individually in a simple conditional model to determine if, by itself, the variable was a correlate of the random growth and/or intercept parameters. Then, the variables that were significant at the first step of analysis were examined simultaneously to determine which correlates were uniquely significant ($p < .05$).

3. Results

Descriptive statistics for measures are presented in Table 2. Based on the TERA-2 and WJ-R standard scores, our sample scored in the average range with slightly higher *SD* values than the normative sample. The intercorrelations among the kin-

Table 2
Descriptive statistics

Variable	Mean	*SD*	Min.	Max.
Kindergarten predictors				
General oral language (factor score)	0.0	1.0	−2.6	1.6
Listening comprehension	5.8	2.9	1	12
Phonological awareness	13.5	8.7	0.0	36
Spelling	8.1	6.8	0	34
TERA-2	106.4	15.0	64	129
Family literacy	28.6	5.7	11	36
Nonverbal IQ	19.1	4.5	5	31
Reading – WJ-R				
Letter Word Identification				
K	103.0	17.3	53	151
1	108.1	18.0	71	149
2	114.1	18.2	73	154
3	111.5	14.9	79	143
Word Attack				
K	103.1	16.1	82	154
1	103.6	23.6	78	168
2	105.8	16.3	73	140
3	113.1	14.1	82	141
Passage Comprehension				
1	106.0	17.6	79	159
2	113.6	15.1	72	143
3	104.7	15.0	82	152

Note. Scores reported are raw scores except for TERA-2 and WJ-R subtest (standard scores); TERA-2 = Test of Early Reading Ability – 2; WJ-R = Woodcock–Johnson Psychoeducational Battery.

Table 3
Intercorrelations among kindergarten predictors

	GOL	LC	PA	Spelling	TERA-2	Family literacy	IQ
GOL	1.00	.75	.69	.40	.69	.81	.28
LC		1.00	.32	.10	.43	.56	.12
PA			1.00	.66	.69	.55	.18
Spelling				1.00	.60	.44	.13
TERA-2					1.00	.55	.22
Family literacy						1.00	.16
IQ							1.00

Note. GOL = General oral language; LC = listening comprehension; PA = phonological awareness; TERA-2 = Test of Early Reading Ability – 2; IQ = nonverbal IQ. For values of $r > .28$, $p < .05$; for values of $r > .38$, $p < .01$.

Table 4
Correlations among predictors and reading variables

	K		1			2			3		
	LWID	WA	LWID	WA	PC	LWID	WA	PC	LWID	WA	PC
Kindergarten predictors											
GOL	.48	.36	.51	.44	.53	.62	.55	.59	.51	.44	.74
LC	.30	.06	.22	.16	.30	.42	.31	.51	.32	.20	.54
PA	.67	.59	.73	.75	.67	.73	.76	.60	.73	.77	.63
Spelling	.68	.76	.68	.73	.67	.55	.64	.42	.50	.52	.49
TERA-2	.85	.62	.81	.72	.81	.71	.72	.71	.70	.65	.73
Family literacy	.51	.27	.54	.40	.59	.59	.48	.67	.57	.45	.75
IQ	.07	−.03	.28	.28	.25	.29	.30	.21	.25	.18	.18

Note. GOL = General oral language; LC = listening comprehension; PA = phonological awareness; TERA-2 = Test of Early Reading Ability – 2; IQ = nonverbal IQ; LWID = Letter Word Identification; WA = Word Attack; PC = Passage Comprehension. For values of $r > .28$, $p < .05$; for values of $r > .38$, $p < .01$.

dergarten predictors are presented in Table 3 and the correlations between the predictors and WJ-R subtest scores for each year are presented in Table 4. We examined the distributional properties of the kindergarten predictor variables to ascertain if the correlations were affected by extreme scores. Skewness was within ± 2 for all variables and equaled 1 or less for six of the seven variables and, thus, was not considered to have an impact on the correlations. The unconditional models are presented in Table 5.

3.1. Letter Word Identification

The unconditional model for LWID was a random intercept, random slope, and fixed quadratic parameter model (see Table 5). The intercept and slope parameters were random, meaning the values vary across students. However, the quadratic parameter was fixed; the rate of deceleration did not vary across students. On average,

Table 5
Estimates for the unconditional models of growth in LWID, WA, and PC

	Fixed effects				Random effects			
	Coefficient	*SE*	*t*	*p*	Estimate	*SE*	*z*	*p*
Letter Word Identification								
Intercept	491.70	3.42	144.00	<.0001	349.71	99.60	3.51	.0002
Slope	14.97	2.88	5.20	<.0001	30.29	13.02	2.33	.0100
Quadratic	−4.97	0.88	−5.67	<.0001				
Residual					122.80	19.54	6.28	<.0001
Word Attack								
Intercept	492.60	2.86	172.41	<.0001	239.93	69.53	3.45	.0003
Slope	12.61	2.38	5.30	<.0001	3.59	5.73	0.63	.2654
Quadratic	−1.44	0.75	−1.90	.0642				
Residual					91.15	14.50	6.28	<.0001
Passage Comprehension								
Intercept	495.65	3.28	151.03	<.0001	268.21	76.17	3.52	.0002
Slope	23.24	1.56	14.88	<.0001				
Residual					195.13	31.05	6.28	<.0001

Note. $df = 39$. LWID = Letter Word Identification; WA = Word Attack; PC = Passage Comprehension.

the predicted third grade reading LWID W score was 491.70, students' linear rate of growth was 14.97 W score points, and the quadratic rate of growth was −4.97 W score points per year. Because the estimated growth rate is a quadratic function, the rate of growth necessarily varies with time. The growth rate at any point along the trajectory can be determined by taking the first derivative of the quadratic equation. At second grade, the rate of growth is $14.97 + (2)(-4.97)(-1) = 24.91$ W score units per year. The rate of growth in LWID W score units at third grade is 14.97 units per year.

The results of the simple and complete conditional model for LWID are presented in Table 6. In the simple conditional models, phonological awareness, general oral language, spelling, TERA-2, family literacy, and SES were significant correlates of the intercept. In the complete conditional model, only phonological awareness, TERA-2, and family literacy were uniquely significant correlates of the intercept explaining 54% of the explainable variance in third grade reading. Spelling and TERA-2 were significant correlates of the slope when examined independently, and only TERA-2 was significant when examined simultaneously. TERA-2 explained 46% of the explainable variance in LWID growth.

3.2. Word attack

The unconditional model for WA was a random intercept, random slope, and fixed quadratic model (see Table 5). Similar to LWID, the intercept and slope varied while the quadratic parameter was fixed. Although in this model the random effect of slope exceeded our criterion of $p \leqslant .20$, the residuals were more equally distributed

Table 6
Conditional models for LWID

	Simple conditional model				Complete conditional model			
	Estimate	*SE*	*t*	*p*	Estimate	*SE*	*t*	*p*
Intercept								
GOL	6.72	1.52	4.42	<.0001	−3.32	2.02	−1.64	.1057
PA	14.21	2.44	5.83	<.0001	7.37	2.66	2.77	.0071
Spelling	9.81	3.18	3.08	.0029	−0.04	3.51	−0.01	.9907
TERA-2	13.05	2.64	4.94	<.0001	8.44	3.75	2.25	.0275
Family literacy	11.16	2.82	3.95	.0002	5.14	2.53	2.03	.0460
Primary language	−7.12	7.40	−.96	.3387				
SES	14.23	6.36	2.24	.0280	−0.89	4.08	−0.22	.8274
IQ	5.90	3.21	1.84	.0700				
Slope								
GOL	−1.25	0.63	−1.97	.0519				
PA	−2.11	1.14	−1.85	.0678				
Spelling	−3.53	1.19	−2.98	.0040	−1.00	1.35	−0.74	.4616
TERA-2	−4.24	0.98	−4.31	<.0001	−4.04	1.33	−3.04	.0033
SES	1.81	2.38	0.76	.4489				
Family literacy	−1.75	1.56	−1.52	.1332				
Primary language	3.54	2.59	1.37	.1760				
IQ	0.36	1.19	0.30	.7658				

Note. GOL = General oral language; PA = phonological awareness; TERA-2 = Test of Early Reading Ability – 2; SES = free or reduced lunch status; IQ = nonverbal IQ; LWID = Letter Word Identification.

compared to the random intercept, fixed slope model. Further, the selected model demonstrated improved fit over the simpler model, χ^2, 1 $(N = 40) = 4.9$, $p < .05$. On average, predicted third grade WA W score was 492.60. Growth was best characterized by a linear parameter of 12.61 W score units per year and a quadratic parameter of −1.44 W score units per year indicative of deceleration.

For WA, the following were significant correlates of the intercept when tested individually in the simple conditional model: phonological awareness, general oral language, spelling, emergent reading, and family literacy (see Table 5). In the complete conditional level, phonological awareness, spelling, and emergent reading were unique significant correlates of the intercept (see Table 7). These variables accounted for 68% of the explainable intercept variance in third grade WA. No variables were significant correlates of the slope in the simple conditional model. This is likely due to (a) little slope variance to be explained (residual intraclass correlation = .038; Singer, 1998) and (b) the conditional model, while considerably improving the fit of the intercept, did not improve the fit of the slope (explainable variance = 0).

3.3. Passage comprehension

The unconditional growth model for PC was a random intercept and fixed slope model. Because there were only three data points (this subtest was not administered

Table 7
Conditional models for WA

	Simple conditional model				Complete conditional model			
	Estimate	*SE*	*t*	*p*	Estimate	*SE*	*t*	*p*
Intercept								
GOL	5.82	1.24	4.68	<.0001	−1.07	1.38	−0.77	.4433
PA	13.31	1.78	7.47	<.0001	6.46	2.00	3.23	.0019
Spelling	10.26	2.49	4.13	<.0001	4.55	1.69	2.69	.0088
TERA-2	12.41	1.99	6.25	<.0001	8.00	1.87	4.28	<.0001
Family literacy	8.56	2.43	3.52	.0007	−1.07	1.92	−0.55	.5808
SES	8.17	5.49	1.49	.1403				
Primary language	−9.38	6.06	−1.55	.1259				
IQ	3.92	2.73	1.44	.1542				
Slope								
GOL	0.17	0.42	0.40	.6927				
PA	0.23	0.75	0.31	.7568				
Spelling	−1.19	0.77	−1.56	.1233				
TERA-2	−0.49	0.75	−0.66	.5140				
SES	0.56	1.51	0.37	.7144				
Family literacy	0.57	0.75	0.76	.4489				
Primary language	0.72	1.67	0.43	.6688				
IQ	−0.10	0.75	−0.13	.8972				

Note. GOL = General oral language; PA = phonological awareness; TERA-2 = Test of Early Reading Ability – 2; SES = free or reduced lunch status; IQ = nonverbal IQ; WA = Word Attack.

in kindergarten), the quadratic parameter could not be tested. On average, the predicted third grade W score was 495.65. The predicted rate of growth was an increase of 23.24 W score points per year. The results are presented in Table 5.

The conditional model for PC predicted only the intercept because the slope parameter was fixed. In the simple conditional model of the intercept, phonological awareness, general oral language, listening comprehension, spelling, emergent reading, family literacy, and SES were significant correlates of the intercept. Table 8 shows that, in the complete conditional model, emergent reading and family literacy were unique significant correlates of third grade performance in PC. These variables accounted for 69% of the explainable variance in third grade PC.

4. Discussion

In this exploratory study, we examined the developmental functions of early reading skills across four years and the predictors of those functions in an unselected sample of kindergarten children. The predictors represented a broad sampling of theoretically relevant variables allowing categorization of the predictors as ‘‘inside-out’’ and ‘‘outside-in’’ processes described by Whitehurst and Lonigan (1998) as central to the transition from emergent to conventional reading.

Table 8
Conditional models for PC

	Simple Conditional Model				Complete Conditional Model			
	Estimate	*SE*	*t*	*p*	Estimate	*SE*	*t*	*p*
Intercept								
GOL	7.40	1.11	6.67	<.0001	−2.50	2.22	−1.12	.2645
LC	8.63	2.58	3.35	.0013	1.34	2.19	0.61	.5444
PA	12.36	2.14	5.77	<.0001	3.18	2.72	1.17	.2475
Spelling	10.26	2.56	4.01	.0001	−0.14	2.29	−0.06	.9518
TERA-2	15.15	1.65	9.17	<.0001	10.84	2.69	4.03	.0001
Family literacy	13.08	2.03	6.46	<.0001	7.26	2.55	2.85	.0058
SES	14.23	6.36	2.24	.0280	−2.71	4.17	−0.65	.5174
Primary language	−8.57	6.96	−1.23	.2203				
IQ	4.35	2.85	1.53	.1306				

Note. GOL = General oral language; LC = listening comprehension; PA = phonological awareness; TERA-2 = Test of Early Reading Ability – 2; SES = free or reduced lunch status; IQ = nonverbal IQ; PC = Passage Comprehension.

The developmental functions for both LWID and WA indicated that children varied sufficiently on third grade performance as well as on linear growth from kindergarten to third grade to analyze correlates of the intercepts and slopes. Both unconditional models had a fixed quadratic effect, indicating that rate of growth slowed over time and was uniform for this sample. These unconditional models were similar to those reported by Torgesen et al. (1999) for a sample representing children from kindergarten to second grade. Torgesen et al. also reported a fixed cubic effect for real word reading. In the current study, PC was best described as varying across children at third grade with a rate of linear growth that was constant.

The prediction of third grade performance and growth varied by type of reading skill assessed. Six of the eight variables (all but nonverbal intelligence and primary language) were significant *individual* predictors of third grade word reading skill (LWID). However, only phonological awareness, emergent reading (TERA-2), and family literacy retained their significance as predictors of the intercept parameter in the conditional model. Thus, we conclude that these three skills mediated the influence of general oral language, spelling, and SES. Spelling and emergent reading, when analyzed individually, predicted growth in word reading skill, but only emergent reading was a unique correlate of growth.

Third grade word attack skill was predicted by five of the eight correlates with phonological awareness, spelling, and emergent reading being unique predictors in the conditional model. Although we allowed slope to vary, none of the correlates was significant in the simple conditional model. It is likely that there was insufficient slope variance in this sample. Only third grade performance could be predicted in the model for PC. Seven of the nine correlates were significant with nonverbal intelligence and primary language being the exceptions. Emergent reading and family literacy were significant unique predictors in the conditional model. The significant effect for emergent reading parallels previous analyses of this sample through second grade in which we also found a unique influence for semantic skills (Roth et al., 2002). In the current study,we anticipated that listening comprehension would have a unique effect, but its influence was mediated by the other correlates.

The pattern of findings yields several themes important to understanding the development of early reading. First, consistent with a large body of research, phonological awareness was a unique predictor of third grade word-level knowledge (LWID and WA) even in the presence of many other relevant variables. The contribution of the present set of findings with respect to phonological awareness is the robustness of its predictive power in the presence of a broader array of oral language skills than is generally studied. It appears that the unique linguistic roots of word-level reading at third grade are limited to the influence of phonological awareness skill. However, phonological awareness did not individually or uniquely predict *growth* in LWID. For growth, only emergent reading, as measured by TERA-2, was a unique predictor. It is of interest to note that this coefficient had a negative value indicating that kindergarten children who had lower TERA-2 scores grew at a faster rate than did kindergarten children who had higher TERA-2 scores. Growth curve analysis provides insight not only on the level of children's skill at the endpoint but also on how they arrived at that point.

A second theme is the role played by family literacy in the prediction of both LWID and PC. As an "outside-in" variable it supports the conceptual model proposed by Whitehurst and Lonigan (1998) in that family literacy was predictive of reading when comprehension skills become more developed. However, the prominence of family literacy in our results was not predicted by the findings of Whitehurst and Lonigan, who reported that the effect of family literacy on reading was mediated by oral language skills. Similarly, Cooper et al. (2002), using the same dataset as in the present study but employing hierarchical regression analyses from kindergarten to second grade, showed that oral language but not family literacy predicted phonological awareness skills from kindergarten to first and second grade. However, family literacy predicted oral language skill in kindergarten.

The current findings were just the opposite with respect to the relative importance of oral language and family literacy: the influence of oral language was mediated, in part, by family literacy. The differences in results across studies may be due to variations in sampling, developmental time frame, measurement, or statistical approach. For example, both Whitehurst and Lonigan (1998) and Cooper et al. (2002) studied children through second grade whereas the current study extended to third grade using a different analysis strategy. We should note that general oral language and family literacy shared considerable variance and had the highest bivariate correlation of any of the predictors ($r = .81$, see Table 3). The most parsimonious explanation may be that young children's background in family literacy and oral language lays a foundation for development of reading skill.

A third theme is the potential of TERA-2, as a measure of emergent reading, for future investigations of reading development. It was a unique predictor of all three third grade reading measures and a unique predictor of growth in LWID. It could be argued that TERA-2 operated as an autoregressor for third grade reading, which would explain its strong performance. The TERA-2 is composed of three types of items: knowledge of the alphabet and its functions, construction of meaning, and conventions of written language. Our sample earned a median raw score of 20, which would include the following distribution of items: 8 alphabet, 7 construction of meaning, and 5 conventions of written language. The higher numbered items in this set require a child to select a whole word from a set of four printed words (alphabet), name and report the function of coupons (construction of meaning), and track print as the examiner reads text (conventions of written language). These items represent a broader array of skills than conventional reading so it appears that the TERA-2 is more than just an autoregressor for early reading skill.

The skills assessed by TERA-2 represent both inside-out (alphabetic skills) and outside-in (conventions of written language and construction of meaning) processes. As a mixed bag of skills, it may be theoretically complex, but this complexity may be responsible for accounting for variance that single measures of the same constructs cannot. As a measure of emergent reading, the TERA-2 perhaps captures simultaneously the interdependence between inside-out and outside-in processes proposed by Whitehurst and Lonigan (1998). Early interventionists may wish to incorporate the skills represented by conventions of written language and construction of meaning in the design of instruction.

The pattern of results extends the model of emergent to conventional literacy proposed by Whitehurst and Lonigan (1998) to third grade and suggests that early contextual understandings necessary for competent reading (family literacy, emergent reading) become more influential as reading skills develop. This conclusion must be placed in the context of a small sample and the exploratory nature of the study. It may be, for example, that general oral language would have had a unique effect on LWID if more children were in the sample. Nonetheless, we suggest that research in reading development would benefit from consideration of a broader array of correlates beyond the traditional emphasis on inside-out skills.

References

Aram, D., & Nation, J. (1980). Preschool language disorders and subsequent language and academic difficulties. *Journal of Communication Disorders, 13*, 158–170.

Ball, E., & Blachman, B. (1991). Does phoneme awareness training in kindergarten make a difference in early word recognition and developmental spelling? *Reading Research Quarterly, 26*, 49–66.

Bashir, A. S., & Scavuzzo, A. (1992). Children with language disorders: Natural history and academic success. *Journal of Learning Disabilities, 25*, 53–65.

Beck, M. D. (1992). Review of the test of early reading ability. In J. J. Kramer, & J. C. Conoley (Eds.), *The eleventh mental measurement yearbook* (2nd ed., pp. 942–944). Lincoln, NE: The University of Nebraska, Lincoln, The Buros Institute of Mental Measures.

Bishop, D., & Adams, C. (1990). A prospective study of the relationship between specific language impairment, phonological disorders, and reading retardation. *Journal of Child Psychology and Psychiatry, 21*, 1027–1050.

Bryant, P., MacLean, M., & Bradley, L. (1990). Rhyme, language, and children's reading. *Applied Psycholinguistics, 11*, 237–252.

Carrow-Woolfolk, E. (1985). *Test for the auditory comprehension of language – revised.* Allen, TX: DLM Teaching Resources.

Catts, H. W., Fey, M. E., Zhang, X., & Tomblin, J. B. (1999). Language basis of reading and reading disabilities: Evidence from a longitudinal investigation. *Scientific Study of Reading, 3*, 331–361.

Christian, K., Morrison, F. J., & Bryant, F. (1998). Predicting kindergarten academic skills: Interactions among child care, maternal education, and family literacy environments. *Early Childhood Research Quarterly, 13*, 501–521.

Compton, D. L. (2000). Modeling the growth of decoding skills in first grade children. *Scientific Studies in Reading, 4*, 219–259.

Cooper, D. H., Roth, F. P., Speece, D. L., & Schatschneider, C. (2002). The contribution of oral language skills to the development of phonological awareness. *Applied Psycholinguistics, 23*, 399–416.

Crocker, L. (1992a). Review of the test of language development – primary: 2. In J. J. Kramer, & J. C. Conoley (Eds.), *The eleventh mental measurement yearbook* (pp. 964–965). Lincoln, NE: The University of Nebraska, Lincoln, The Buros Institute of Mental Measures.

Crocker, L. (1992b). Review of the clinical evaluation of language fundamentals. In J. J. Kramer, & J. C. Conoley (Eds.), *The eleventh mental measurement yearbook* (pp. 189–190). Lincoln, NE: The University of Nebraska, Lincoln, The Buros Institute of Mental Measures.

Dunn, L., & Dunn, L. (1981). *Peabody picture vocabulary test – revised*. Circle Pines, MN: American Guidance Service.

Foorman, B. R., Francis, D. J., Mehta, P., Schatschneider, C., & Fletcher, J. M. (1997). Early interventions for children with reading disabilities. *Scientific Studies of Reading, 1*, 255–276.

Foorman, B. R., Francis, D. J., Novy, D. M., & Liberman, D. (1991). How letter sound instruction mediates progress in first grade reading and spelling. *Journal of Educational Psychology, 83*, 456–469.

Francis, D. J., Fletcher, J. M., Steubing, K. K., Davidson, K. C., & Thompson, N. M. (1991). Analysis of change: Modeling individual growth. *Journal of Clinical and Consulting Psychology, 59*, 27–37.

Francis, D. J., Schatschneider, C., & Carlson, C. (2000). Introduction to growth curve analysis. In D. Drotar (Ed.), *Handbook of research in pediatric and clinical child psychology* (pp. 51–73). New York: Kluwer Academic.

Fuchs, D., Fuchs, L., Thompson, A., Al Otaiba, S., Yen, L., Yang, N. J., Braun, M., & O'Connor, R. E. (2001). Is reading important in reading-readiness programs. A randomized field trial with teachers as program implementers. *Journal of Educational Psychology, 93*, 251–267.

Gentry, J. R., & Gillet, J. W. (1993). *Teaching kids to spell*. Portsmouth, NH: Heineman.

Goodglass, H., & Kaplan, E. (1983). *The Boston naming test*. Philadelphia, PA: Lea and Febriger.

Griffin, E. A., & Morrison, F. J. (1997). The unique contribution of home literacy environment to differences in early literacy skills. *Early Child Development and Care, 127–128*, 233–243.

Hayes, A. E. (1997). *Even Start: An effective literacy program helps families grow toward independence*. Louisville, KY: National Center for Family Literacy.

Hayes, W. O. (1989). Review of the test for auditory comprehension of language. In J. C. Conoley, & J. J. Kramer (Eds.), *The tenth mental measurements yearbook* (pp. 824–826). Lincoln, NE: The University of Nebraska, Lincoln, The Buros Institute of Mental Measures.

Hiltonsmith, R. W. (1992). Review of the test of early reading ability. In J. J. Kramer, & J. C. Conoley (Eds.), *The eleventh mental measurement yearbook* (2nd ed., pp. 944–946). Lincoln, NE: The University of Nebraska, Lincoln, The Buros Institute of Mental Measures.

Jacobsen, L. (1994). Establishing the functions of print test and the family literacy scale as valid indicators of print awareness. Unpublished Masters thesis, University of Maryland.

Lonigan, C. L., Burgess, S. R., & Anthony, J. L. (2000). Development of emergent literacy and early reading skills in preschool children: Evidence from a latent variable longitudinal study. *Developmental Psychology, 36*, 596–613.

Marston, D. B. (1989). A curriculum-based measurement approach to assessing academic performance: What it is and why do it?. In M. R. Shinn (Ed.), *Curriculum-based measurement* (pp. 18–78). New York: Guilford Press.

Morris, R. D., Stuebing, K. K., Fletcher, J. M., Shaywitz, S. E., Lyon, G. R., Shankweiler, D. P., Katz, L., Francis, D. J., & Shaywitz, B. E. (1998). Subtypes of reading disability: Variability around a phonological core. *Journal of Educational Psychology, 90*, 347–373.

Morrison, F., McMahon-Griffith, E., Williamson, G. L., & Harway, C. L. (1993). Family literacy environment, learning related social skills and academic achievement. Paper presented at the Second Annual Head Start Conference, Washington, DC.

National Reading Panel (2000). *Teaching children to read: An evidence-based of the scientific research literature on reading and its implications for reading instruction*. Bethesda, MD: National Institutes of Health.

Newcomer, P. L., & Hammill, D. D. (1998). *Test of language development – primary* (2nd ed.). Austin, TX: Pro-Ed.

Raven, J. C. (1965). *The coloured progressive matrices test*. London: Lewis.

Reid, D. K., Hresko, W. P., & Hammill, D. D. (1989). *Test of early reading* (2nd ed.). Austin, TX: Pro-Ed.

Roth, F., Speece, D. L., Cooper, D. H., & DeLaPaz, S. (1996). Unresolved mysteries: How do metalinguistic and narrative skills connect with early reading? *Journal of Special Education, 30*, 257–277.

Roth, F. P., Speece, D. L., & Cooper, D. H. (2002). A longitudinal analysis of the connection between oral language and reading. *Journal of Educational Research, 95*, 259–272.

Salvia, J., & Ysseldyke, J. (1995). *Assessment* (6th ed.). Boston: Houghton Mifflin.

Salvia, J., & Ysseldyke, J. (2001). *Assessment* (8th ed.). Boston: Houghton Mifflin.

San Felipe-Del Rio Consolidated Independent School District (1975). Del Rio english story comprehension test.

SAS Institute, Inc., 1999. SAS/STAT user's guide. Version 8. Cary, NC: Author.

Sattler, J. M. (1988). *Assessment of children* (3rd ed.). San Diego: Author.

Scarborough, H. S. (1998). Early identification of children at risk for reading disabilities: Phonological awareness and some promising predictors. In B. K. Shaprio, P. J. Accardo, & A. J. Capute (Eds.), *Specific reading disability: A view of the spectrum* (pp. 75–119). Timonium, MD: York Press.

Schuhfried, G. (2003). Raven's coloured progressive matrices. Retrieved June 17 2003, Available: www.schuhfried.at/eng/wts/cpm.htm.

Semel, E., Wiig, E., & Secord, W. (1987). *Clinical evaluation of language fundamentals – revised*. San Antonio, TX: The Psychological Corporation.

Shapiro, D. A. (1992). Review of the clinical evaluations of language fundamentals. In J. J. Kramer, & J. C. Conoley (Eds.), *The eleventh mental measurement yearbook* (pp. 190–194). Lincoln, NE: The University of Nebraska, Lincoln, The Buros Institute of Mental Measures.

Singer, J. D. (1998). Using SAS PROC MIXED to fit multilevel models, hierarchical models, and individual growth models. *Journal of Educational and Behavioral Statistics, 24*, 323–355.

Snow, C., Burns, M. S., & Griffin, P. (Eds.). (1998). *Preventing reading difficulties in young children*. Washington, DC: National Research Council.

Snow, C. E., Tabors, P. O., Nicholson, P. A., & Kurland, B. F. (1995). SHELL: Oral language and early literacy skills in kindergarten and first grade children. *Journal of Research in Childhood Education, 10*, 37–48.

Speece, D. L., Roth, F. P., Cooper, D. H., & De La Paz, S. (1999). The relevance of oral language skills to early literacy: A multivariate analysis. *Applied Psycholinguistics, 20*, 167–190.

Stage, S. A., Sheppard, J., Davidson, M. M., & Browning, M. M. (2001). Prediction of first-graders' growth in oral reading fluency using kindergarten letter fluency. *Journal of School Psychology, 39*, 225–237.

Tangel, D. M., & Blachman, B. (1992). Effect of phoneme awareness instruction on kindergarten children's invented spelling. *Journal of Reading Behavior, 24*, 233–261.

Tindal, G. A., & Marston, D. B. (1990). *Classroom-based assessment: Evaluating instructional outcomes*. Columbus, OH: Merrill Publishing.

Torgesen, J. K., Wagner, R. K., Rashotte, C. A., Lindamood, P., Rose, E., Conway, T., & Garvan, C. (1999). Preventing reading failure in young children with phonological processing disabilities: Group and individual differences to instruction. *Journal of Educational Psychology, 91*, 579–593.

Vellutino, F. R., Scanlon, D. M., Sipay, E. R., Small, S. G., Pratt, A., Chen, R., & Denckla, M. B. (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.

Wagner, R. K., Torgesen, J. K., Laughon, P., Simmons, K., & Rashotte, C. (1993). Development of young readers' phonological processing abilities. *Journal of Educational Psychology, 85*, 83–103.

Wagner, R. K., Torgesen, J. K., & Rashotte, C. (1994). Development of reading-related phonological processing abilities: New evidence of bi-directional causality from a latent variable longitudinal study. *Developmental Psychology, 30*, 73–87.

Wagner, R. K., Torgesen, J. K., Rashotte, C. A., Hecht, S. A., Barker, T. A., Burgess, S. R., Donahue, J., & Garon, T. (1997). Changing relations between phonological processing abilities and word-level reading as children develop from beginning to skilled readers: A 5-year longitudinal study. *Developmental Psychology, 33*, 468–479.

Wagner, R. K., Torgesen, J. K., & Rashotte, C. (1999). *Comprehensive test of phonological processing*. Austin: Pro-Ed.

Weinberger, J. (1996). A longitudinal study of children's early literacy experiences at home and later literacy development at home and school. *Journal of Research in Reading, 19*, 14–24.

Westby, C. E. (1992). Review of test of language development – primary: 2. In J. J. Kramer, & J. C. Conoley (Eds.), *The eleventh mental measurement yearbook* (pp. 965–966). Lincoln, NE: The University of Nebraska, Lincoln, The Buros Institute of Mental Measures.

Whitehurst, G. J., & Lonigan, C. J. (1998). Child development and emergent literacy. *Child Development, 69*, 848–872.

Woodcock, R. W., & Johnson, M. B. (1989). *Woodcock–Johnson psychoeducational battery – revised*. Allen, TX: DLM.