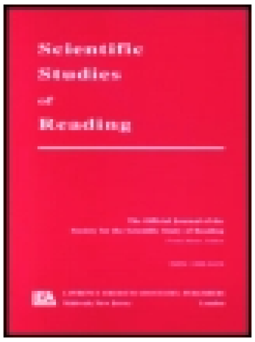

Scientific Studies of Reading

ISSN: 1088-8438 (Print) 1532-799X (Online) Journal homepage: http://www.tandfonline.com/loi/hssr20

Beyond the Reading Wars: Exploring the Effect of Child-Instruction Interactions on Growth in Early Reading

Carol McDonald Connor , Frederick J. Morrison & Leslie E. Katch

To cite this article: Carol McDonald Connor , Frederick J. Morrison & Leslie E. Katch (2004) Beyond the Reading Wars: Exploring the Effect of Child-Instruction Interactions on Growth in Early Reading, Scientific Studies of Reading, 8:4, 305-336, DOI: 10.1207/s1532799xssr0804_1

To link to this article: http://dx.doi.org/10.1207/s1532799xssr0804_1

Published online: 19 Nov 2009.

SCIENTIFIC STUDIES OF READING, *8*(4), 305–336

Beyond the Reading Wars: Exploring the Effect of Child–Instruction Interactions on Growth in Early Reading

Carol McDonald Connor, Frederick J. Morrison, and Leslie E. Katch
University of Michigan

This study examined the influence of interactions between first graders' fall language–literacy skills (vocabulary and decoding) and classroom instructional practices on their spring decoding scores. Instructional activities were coded as teacher managed or child managed and as explicit or implicit, as well as for change in amount of time spent in the activity over the school year. Findings revealed that specific patterns of instructional activities differentially predicted children's decoding skill growth. Children with low initial decoding scores achieved greater decoding growth in classrooms with more time spent in teacher-managed explicit decoding (TME) instruction. In contrast, for children with initially high decoding scores, amount of TME had no effect. Children with low initial vocabulary scores achieved greater decoding score growth in classrooms with less child-managed implicit (CMI) instruction but with increasing amounts of CMI instruction as the school year progressed. However, children with high initial vocabulary scores achieved greater decoding growth in classrooms with more time spent in CMI activities and in consistent amounts throughout the school year. Children's initial decoding and vocabulary scores also directly and positively affected their decoding score growth. These main effects and interactions were independent and additive, thus children's first-grade decoding skill growth was affected by initial vocabulary and decoding skill as well as type of instruction received—but the effect of type of instruction (TME or CMI amount and change) depended on children's initial vocabulary and decoding scores. Implications for research and educational practices are discussed.

Requests for reprints should be sent to Carol McDonald Connor, Florida State University and the Florida Center for Reading Research, City Centre Building, 227 North Bronough Street, Suite 7250, Tallahassee, FL 32301. E-mail: cconnor@fcrr.org

There has been long-standing controversy regarding the best way to teach children how to read (Ravitch, 2001). The debate has been fueled, in part, because each year significant numbers of American children fail to reach functional levels of literacy (National Assessment of Educational Progress, 2000). In essence, the debate has centered on the efficacy of phonics or code-based instruction versus whole language or meaning-based instruction (Rayner, Foorman, Perfetti, Pesetsky, & Seidenberg, 2001). Code-based instruction focuses on explicit and systematic training in decoding including letter recognition, letter–sound correspondence, phonics, and phonological awareness. Meaning-based instruction views learning to read as a more natural process (Goodman, 1970) that requires consistent experience with meaningful text within a literature-rich environment (Dahl & Freppon, 1995). Unfortunately, as Rayner et al. noted, "the continued dichotomy of reading philosophies produces fragmented instruction in classrooms rather than the integrated balance of skills and meaningful applications that research suggests are needed to produce successful readers" (p. 61). Evidence accumulating systematically over the past 20 years has documented that a combination of methods may better support children's developing literacy. Most children appear to develop stronger reading skills when provided explicit decoding instruction in combination with meaningful reading activities (Guthrie, Schafer, & Huang, 2001; Rayner et al., 2001; Taylor, Pearson, Clark, & Walpole, 2000). Consequently, there is a growing trend toward "balanced" instruction in early reading instruction (see also P. Cunningham & Hall, 1998; Hiebert & Raphael, 1998; Pressley, 1998).

Yet, the promotion of balanced instruction leaves open the question of what might be the best combination of basic skills instruction and meaningful reading activities. An implicit and largely untested assumption in much literacy research is that specific instructional practices will be equally effective for all children. This universalistic view can be found in the literature supporting meaning-based instruction (e.g., Dahl & Freppon, 1995) as well as that promoting code-based instruction (National Reading Panel, 2000). However, Child Aptitude × Treatment interaction research, first introduced in the 1970s, revealed that these interactions may be important (Sternberg, 1996). Some recent research has begun to explore the possibility that the efficacy of instructional practices may vary with the skill level of the student. For example, Foorman, Francis, Fletcher, Schatschneider, and Mehta (1998) found that children with weaker phonological awareness at the beginning of the school year demonstrated greater growth in decoding skills in the code-based classrooms than did children with stronger phonological awareness. Juel and Minden-Cupp (2000) found an analogous Reading Group × Classroom Type interaction. In their study, children who started first grade with weaker reading skills (i.e., low-reading group) made more progress in classrooms where there was greater emphasis on word recognition instruction. In contrast, children with stronger reading skills at the beginning of first grade (i.e., middle or high group) achieved greater reading progress in the classroom where the teacher emphasized a literature-rich environment with less emphasis on code-based instruction. A major goal of our study was to further explore the impact of various instructional practices for children entering first grade with different language and reading skill levels.

CHILD CHARACTERISTICS

Children begin school with widely varying abilities in skills that support early literacy development, such as phonological awareness, word decoding, and vocabulary, and these differences emerge surprisingly early (Stevenson, Parker, Wilkinson, Hegion, & Fish, 1976). For example Stipek and Ryan (1997) uncovered large social class differences in both cognitive and early literacy skills among a sample of preschoolers and kindergartners. A recent observational study documented meaningful social class differences in children's acquisition of expressive vocabulary as early as 18 months of age (Hart & Risley, 1995).

Further, these individual differences appear to be largely sustained throughout children's school careers (Entwisle & Alexander, 1988). Scores on decoding, alphabet recognition, and vocabulary tasks at kindergarten entry consistently predicted academic performance throughout the first 3 years of formal schooling experience (Dickinson & Tabors, 2001; Hart & Risley, 1995; Morrison & Cooney, 2002; Stevenson et al., 1976). Additional research has revealed stability for 1st-grade reading skill through 11th-grade reading experience and performance, even after accounting for children's cognitive abilities (A. Cunningham & Stanovich, 1997; A. Cunningham, Stanovich, & West, 1994). Altogether, a growing body of evidence testifies to the very early emergence and stability of variability among children in important literacy and literacy-related skills.

This study attempted to identify and incorporate two important child characteristics—decoding and vocabulary—as they interacted with instructional practice. Decoding skill, specifically alphabet recognition, letter-sound correspondence, and single word decoding, was selected because it is a foundational skill critical to the development of proficient reading (Snow, Burns, & Griffin, 1998) and its instruction is both salient and important in first-grade classrooms (Adams, 1990; Neuman & Dickinson, 2001; Rayner et al., 2001). Children's vocabulary, an integral aspect of language development (Locke, 1997, 1993), varies significantly among children at school entry, and individual differences appear to be relatively stable throughout childhood (Hart & Risley, 1995) and beyond (Nippold, 1988). Further, in two separate studies, there were no significant schooling effects on children's kindergarten or first-grade vocabulary growth (Christian, Morrison, Frazier, & Masseti, 2000; Morrison, Smith, & Dow-Ehrensberger, 1995), yet it is an important predictor of later reading success (Anderson & Freebody, 1981; Catts, Fey, Zhang, & Tomblin, 2001).

INSTRUCTIONAL FACTORS

There is also appreciable variability in amount and type of language arts instruction provided to children across classrooms (Juel & Minden-Cupp, 2000; Taylor et al., 2000; Wharton-McDonald, Pressley, & Hampston, 1998). For instance, Juel and Minden-Cupp (2000) described four classrooms that varied substantially in amounts of meaning and code-based instruction provided over the course of the school year.

Teachers have been observed using elements of both code-based and meaning-based instruction while varying the amount of each type during the school year (Juel & Minden-Cupp, 1998; Rayner et al., 2001; Taylor et al., 2000). Dichotomous or categorical comparisons of classroom instructional practices may be inadequate to describe fully teachers' literacy practices. Grouping teachers by their primary focus (e.g., code- vs. meaning-based) may oversimplify what is actually happening in classrooms and undermine our ability to examine the complex effects of both the amount and types of reading instruction teachers provide. Although instruction has been defined using a number of methods, we wanted to describe instruction in a way that could be used with a range of child outcomes including decoding, comprehension, fluency, and so forth across a variety of classroom grades and settings. Further, we wanted to capture the complexity of instruction while representing it in measurable variables. To this end, and relying on recent studies of children's reading skill development, we selected three specific dimensions of instruction: (a) explicit versus implicit instruction, (b) teacher-managed versus child-managed instruction, and (c) change in type and amount of instruction over time. Each of these dimensions is discussed more fully in the rest of this article. A fourth dimension, word level versus higher order, was not included in this study because it overlapped with the explicit versus implicit dimension. This would not have been the case if our outcome had been, for example, reading comprehension, which might be differentially impacted by implicit word level (e.g., alphabet activities vs. higher order activities—sustained silent reading).

Explicit Versus Implicit Instruction

The first dimension focuses on whether instruction is explicit or implicit in promoting growth of a particular skill, such as word decoding. For example, Foorman and her colleagues (see Foorman et al., 1998) grouped classrooms along the explicit–implicit continuum focusing on decoding skill instruction (i.e., Direct code, Embedded code, Implicit code). In our coding scheme, if, as in this study, word decoding is the targeted skill, then instructional activities such as blending onsets and rhymes or teaching letter-sound correspondence would be considered explicit because the children's attention is primarily directed to components of word decoding strategies. In contrast, activities like teacher-led discussions, in which the child's attention is more explicitly focused on comprehension (i.e., extracting meaning from text), could still influence word-decoding skills in an implicit or incidental fashion. At an intermediate point would be implicit phonics (e.g., Torgesen et al., 2001) where teachers expose children to word lists that contain similar spelling–sound correspondences but do not explicitly teach spelling–sound correspondences. Note that if reading comprehension had been the outcome of interest, different sets of instructional activities would have been defined as explicit or implicit.

As defined, explicit decoding instruction encompasses much of what has been described as code-based instruction including teaching of phoneme–grapheme correspondences, phonological awareness (e.g., onset-rime segmentation, blending phoneme, segmenting phonemes), and letter names and sounds. Implicit decoding instruction includes meaning-based activities like teachers reading to students, discussions about books, teachers and students reading together, and students reading and writing independently.

Teacher-Managed Versus Child-Managed Instruction

The second dimension refers to the degree that instructional activity and the child's attention are primarily under the direction of the teacher (e.g., when the teacher is explicitly instructing the children in word decoding strategies) or primarily controlled by the child (e.g., in sustained silent reading). This dimension is quite similar to methods of instruction such as prescriptive (teacher-managed) and responsive (teacher-managed moving to child-managed) (see Rayner et al., 2001) as well as "child-centered" and "teacher-directed" (Bredekemp & Copple, 1997). However, there are some important differences because the activity is coded according to whether the teacher or the child is responsible for directing attention to or "managing" the learning. Thus, activities that might be considered child-centered activities, such as discussions about books, would be considered *teacher-managed* because the teacher is managing the learning. However, teacher-directed activities, such as completing worksheets, would be considered *child-managed* because the child is responsible for his or her own learning.

Change in Amount of Instructional Activities Over the School Year

One provocative finding in the Juel and Minden-Cupp (2000) study was that some teachers changed their instructional emphasis over the course of the school year. For example, one teacher began the year with a strong focus on explicit, teacher-managed decoding instruction that tapered off as the year progressed and as children mastered basic skills. In this class, children with weaker fall reading skills (i.e., children in the low reading group) achieved stronger spring decoding scores than did children in the low reading group in other classrooms. Thus, how much time the class spends in particular activities at certain times of the school year may be important to consider. In this study, we observed first-grade classrooms three times during the school year (i.e., fall, winter, and spring). Hence, we were able to examine the impact of changes in amount of instructional activities over the course of the school year.

HYPOTHESIS

This study examined first-grade students' decoding skill growth and how it was affected by classroom instructional practices, the skills with which the children began school, and the interactions between instruction and child characteristics. We predicted that children with stronger fall vocabulary or decoding skills would achieve stronger decoding skill growth in classrooms that provided more child-managed implicit decoding instruction and less teacher- managed explicit decoding instruction. In contrast, we expected children with weaker fall vocabulary or decoding scores to achieve stronger decoding skill growth in classrooms that provided more teacher-managed explicit decoding instruction and less child-managed implicit decoding instruction. Finally, we anticipated that changes in amount of different types of decoding instruction over the course of the school year would affect children's decoding growth.

METHODS

Participants

One hundred eight first-grade children taught by 42 teachers participated in this study as part of a larger longitudinal study of schooling conducted in a large midwestern city. Children who were English proficient and had no identified disability were recruited from schools in the participating school district. Children were recruited over 3 consecutive years, with most entering the study during Years 1 and 2.

Descriptive information is provided in Table 1. Of the participants in this study, 44% of the children were girls, 65% were White, 28% were African American, 3% were Hispanic, 2% were Asian, and 2% belonged to other ethnic groups or were not identified. Children's race–ethnicity did not contribute significantly to our outcome in preliminary hierarchical linear models, $t(41) = .27$, $p = .32$, and so was not included in our final model. Children's cognitive abilities were assessed at the beginning of the study using the Stanford-Binet Intelligence Scale–4th Edition (Thorndike, Hagen, & Sattler, 1986), which provides a full-scale intelligence quotient (IQ). On average, this sample demonstrated IQs within normal limits. Further, IQ did not significantly contribute to our outcome in preliminary hierarchical linear models, $t(90) = –.44$, $p = .66$, and so was not included in the final model.

TABLE 1
Descriptive Statistics for Student Participants

	White/Asian		*African American*		*Total*	
	M	*SD*	*M*	*SD*	*M*	*SD*
Decoding fall	26.0	13.5	18.8	11.42	23.27	13.14
Decoding spring	43.7	15.0	33.0	13.3	39.63	15.22
Vocabulary fall	90.6	14.0	73.0	12.2	83.85	15.79
Vocabulary spring	99.1	12.0	80.2	13.8	91.91	15.68
Home literacy score	14.5	2.1	10.1	3.1	12.93	3.29
Mother's educational level (years)	17.4	2.2	13.2	2.7	15.98	3.10
IQ (full-scale standard score)	107.5	13.5	90.9	11.0	101.21	14.95

Note. All reported values are raw scores unless otherwise indicated.

Measures

Individual child assessment. Children were assessed using a battery of tests and tasks in the fall and spring of their first-grade year. These tests included the Peabody Picture Vocabulary Test–Revised (Dunn & Dunn, 1987), which assesses receptive vocabulary (Vocabulary), and the Reading Recognition subtest of the Peabody Individual Achievement Tests–Revised (Markwardt, 1989), which assesses letter identification, letter-sound correspondence, and single word recognition skills (Decoding). Raw scores were used for statistical analyses. When reported as grade equivalents, raw or fitted scores were converted to grade equivalent scores using the tables provided in the examiners' manual.

Parent questionnaire: Mother's educational level and home literacy. Parents completed questionnaires during their 1st year in the study, which provided descriptive information about the family, including mothers' educational levels, expressed in years. Home literacy environment scores (Home Literacy) were also based on the results of parents' responses on a questionnaire. Home Literacy, a composite measure that ranged from 3 (*low*) to 18 (*high*), was derived from parents' responses regarding how frequently they used a library card, number of adult and child magazine subscriptions, number of newspaper subscriptions, how often the family read together, number of children's books, hours of television the child watched per week, and how frequently parents read to themselves (Griffin & Morrison, 1997). Reliability of the measure was adequate (Cronbach's $\alpha = .72$). These parent and home variables were included in the models because of their well-documented association with children's academic and reading success (Snow et al., 1998).

School district, teachers, and classroom observation—Instructional variables. As noted previously, all children and teachers were recruited from the same school district in a large midwestern city. The school district in this study reported that they supported a whole-language approach to literacy instruction and encouraged teachers to provide significant amounts of student-initiated reading and writing activities. Teachers were recruited for the study if a target child attended their classroom. Classroom instruction was observed over the course of the school year during three all-day sessions in the fall, winter, and spring (Connor, Morrison, & Griffin, 2002). Trained observers recorded a narrative description of the school day and the amount of time spent on specific instructional activities. Researchers then coded the activities described in the narratives for type of instruction and length of time the type of activity lasted (in minutes). Descriptions of the activities are provided in the Appendix. For approximately 10% of the observations, two observers observed the same classroom and independently recorded a narrative of the classroom activities. Agreement was calculated by time and description of activity with the number of minutes the observers were in agreement divided by minutes in agreement plus minutes where the observers disagreed. Interobserver agreement for the narrative was 95%. Interrater reliability for the coded activities was calculated in much the same way. The number of minutes the two independent raters coded a description using the same activity code divided by agreements plus disagreements. Interrater reliability was 86%. For this study, only language arts activities were included.

Dimensions of instruction. Instructional activities were coded using the first two dimensions of instruction described previously: explicit versus implicit and teacher-managed versus child-managed (see Table 2). The third dimension, change in amount of instruction over time, is described more fully in the next section.

TABLE 2
Instructional Activities Comprising Each Dimension of Instruction: Teacher-Versus Child-Managed and Explicit Versus Implicit

	Teacher Managed	*Child Managed*
Explicit	Alphabet activity Letter sight–sound Initial consonant stripping Word segmentation	Spelling
Implicit	Vocabulary Teacher read aloud Student read aloud, choral Teacher-managed group writing Writing instruction Discussion Conventions of print Listening comprehension	Student read aloud, individual Sustained silent reading Reading comprehension activity Student independent writing Student group writing

Note. Descriptions of activities are provided in the Appendix.

Instructional activities were coded as explicit or implicit as they pertained to word decoding. Hence instructional activities that taught letters, letter-sound association, phonological awareness, spelling, or decoding words were defined as explicit decoding instructional activities. Other language arts activities were defined as implicitly teaching decoding. For example, the opportunity to read independently while explicitly focusing on fluency implicitly supported children's decoding skills.

Teacher-managed instruction included those activities in which the teacher was the primary director of the children's attention—for example, teacher and student discussions surrounding a particular book or teacher scaffolding–coaching. Other teacher-managed activities included teachers reading aloud and direct instruction in letter-sound relations. *Child-managed instruction* included those instructional activities where the student was primarily controlling his or her focus of attention—for example, reading independently (e.g., sustained silent reading) and completing worksheets independently.

Computing classroom variables and change over time. Because we observed every classroom three times over the course of the school year (there were no missing classroom observations), variables representing types of instruction were expressed as both the number of minutes for amount of instruction (amount centered at winter observation) as well as change in the amount of instruction over the school year (i.e., slope, which is the third dimension of instruction). Variables were computed using the following method. For each observation, the amount of time, in minutes, spent in each type of instructional activity was computed. Using Hierarchical Linear Modeling (HLM; Raudenbush & Bryk, 2002), instructional growth curves for each classroom were modeled at Level 1 using month of the observation centered at the winter evaluation, with the individual classroom modeled at Level 2. Empirical Bayes residuals were calculated for each classroom using the HLM software (Version 5.0). This provided an instruction amount score and an instruction slope score for each classroom teacher based on the observations in his or her classroom.

Each classroom amount score represents the amount of time in minutes that a particular teacher spent in one type of activity, which was above or below the fitted mean for all teachers, centered at the winter observation. As an illustration, suppose Teacher A's instruction amount score in teacher-managed explicit (TME) instruction was 3.4. This means that, on average, she spent 3.4 min more than the average number of minutes teachers in the study spent in this type of instruction, which was 7.4 min. In other words, she spent a total of 10.8 min (7.4 + 3.4) per day in TME instruction. In contrast, hypothetical Teacher B's instruction amount score was –2.5. This means that she spent 2.5 min less than the average time spent on this type of instruction compared to the mean of all teachers, or 5.1 min (7.4–2.5) per day. Instruction slope score was calculated in the same way, but using the slope rather than the intercept. Thus, there was a fitted mean slope for all of the classrooms (fitted slope TME instruction = –.58) and an individual teacher slope score, which represented his or her difference from the mean slope. This procedure was followed for each dimension of instruction variable (see Table 2). These variables were then used in the final model at Level 2, as described next. To recap, these amount and slope variables included TME, child-managed explicit (CME), teacher-managed implicit (TMI) and child-managed implicit (CMI).

Analytic Strategy

HLM (Raudenbush & Bryk, 2002) was used to control for the nested nature of the data: Children nested in classrooms. On average, there were more than two children per classroom. However three classrooms had as many as six children, whereas a few had only one. Had we used regression instead of HLM, we might have overestimated the effect of instruction on children's outcomes because we would not have accounted for the shared classroom variance (Raudenbush & Bryk, 2002). Child-level variables were entered at Level 1; classroom variables were entered at Level 2 (see Equation 1).

Level 1

$$Y_{ij} = \beta_{0j} + \beta_{1j}(\text{Mother's Education})_{ij} + \beta_{2j}(\text{Home Literacy})_{ij} + \beta_{3j}(\text{fall Vocabulary})_{ij} + \beta_{4j}(\text{fall Decoding})_{ij} + r_{ij}$$

Level 2

$$\beta_{0j} = \gamma_{00} + \gamma_{10}(\text{Classroom instruction variables})_j + u_{0j}$$
$$\beta_{1j} = \gamma_{10} + u_{1j}$$
$$\beta_{2j} = \gamma_{20}$$
$$\beta_{3j} = \gamma_{30} + \gamma_{31}(\text{Classroom instruction variables})_j$$
$$\beta_{4j} = \gamma_{40} + \gamma_{41}(\text{Classroom instruction variables})_j$$

Y_{ij}, which is the Decoding score for Child i in Class j, is a function of the respective coefficients (β) at Level 1 as they pertain to Mothers' Educational Levels, Home Literacy, fall Vocabulary, and fall Decoding, as well as a residual (r_{ij}). β_{0j} is a function of the fitted mean for the group of students (γ_{00}) plus the effect of the classroom instruction variables for Classroom j, plus error (u). γ_{10} represents the effect of mother's education on spring Decoding. γ_{20} represents the effect of Home Literacy environment on spring Decoding score. γ_{30} represents the effect of fall Vocabulary, and γ_{40} represents the effect of fall Decoding on spring Decoding. γ_{31} represents the interaction between instruction variables and fall Decoding. γ_{41} is the interaction between fall Vocabulary and instruction variables. The error at the level of the classroom is represented by u_j. For all models presented, residuals were assumed to be normally distributed with means of zero.

RESULTS

Variation in Classroom Instruction

Results revealed significant differences in amount and change (i.e., slope) of instruction type provided in classrooms over the course of the school year. As depicted in Table 3 and Figure 1, overall, teachers provided significant amounts of each type of instruction—TME, CME, TMI, and CMI. They also significantly changed the amount of TME, CME, and CMI (but not TMI) instruction they provided over the course of the school year. In general, teachers provided more TME and CME at the beginning of the school year and significantly less as the year progressed (see Figure 1), as indicated by significant and negative slope coefficients (see Table 3). In contrast, teachers increased the overall amount of CMI instruction over the course of the school year, as demonstrated by the significant positive slope coefficient.

Teachers differed substantially in the total amount of language arts instruction they provided (i.e., sum of TME, CME, TMI, and CMI) ranging from 5 to 134 min of language arts instruction per day on the actual days observed ($M = 63.5$, $SD = 26.5$). Table 3 provides means (centered at the winter observation) and standard deviations for each type of instruction calculated using HLM. The length of the school day did not differ across classrooms because all of the teachers taught within the same school district.

TABLE 3
Descriptive Information for Instructional Variables

	M	*SD*	*SE*	*Level 2 Variance (u)*	*Level 1 Variance (r)*
Total Language Arts amount	63.50	10.27	NA	NA	NA
TME amount	7.43***	3.53	1.04	24.39***	69.77
TME slope	–.82*	.58	.32	.83	
CME amount	4.27***	2.52	.62	9.61***	23.49
CME slope	–.58**	.62	.19	.58	
TMI amount	23.26***	3.52	1.52	32.29*	211.63
TMI slope	–.72	1.56	.62	5.40*	
CMI amount	28.54***	9.45	2.11	130.12***	200.20
CMI slope	2.26**	1.99	.67	8.61**	

Note. Fitted means (in minutes) and slopes (in minutes per month) computed using Hierarchical Linear Modeling. NA = data not applicable; TME = teacher-managed explicit; CME = child-managed explicit; TMI = teacher-managed implicit; CMI = child-managed implicit.

*$p < .05$. **$p < .01$. ***$p < .001$.

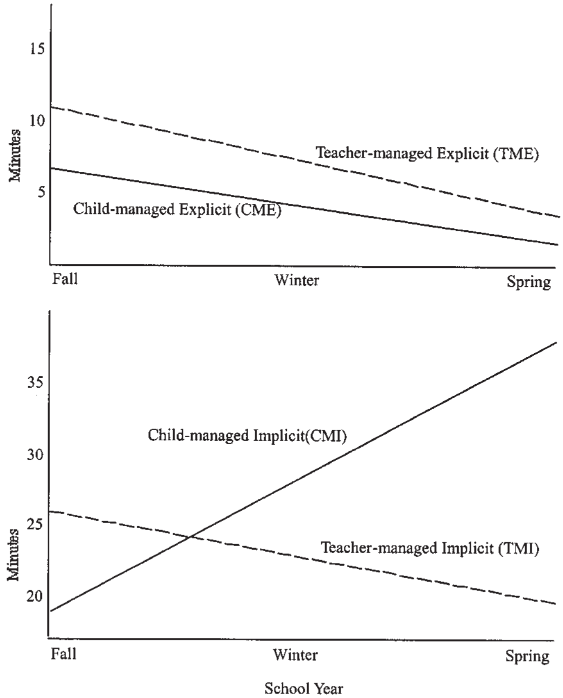

FIGURE 1 Graph of the fitted growth curves of the amount (in minutes/day) and slope (in minutes per month) in the four classroom instruction variables, teacher-managed explicit (TME), child-managed explicit (CME), teacher-managed implicit (TMI), and child-managed implicit (CMI).

Teachers also differed in the emphasis they placed on the type of instruction, as indicated by the significant variance at Level 2 for these variables (see Table 3). Some teachers spent relatively more time on TME, others on CMI, others spent little time on either TME or CMI, but there was not a simple trade-off as evidenced by the low and nonsignificant correlation between the amounts for each type of instruction (see Table 4). On average, teachers provided significantly more CMI than TME—7.4 min per day of TME compared to 28.5 min per day of CMI ($t = 14.26$).

Of the change variables, only CMI and TMI slopes varied significantly among teachers. Some teachers started the school year providing less time in CMI or TMI and increased the amount as the year progressed, whereas other teachers provided the same amount all year long. Still others decreased the amount of TMI provided.

TME amount and slope were highly and negatively correlated (t $r = -.88$) so that teachers who provided higher amounts of TME instruction in the fall tended to decrease the amount taught more sharply over the school year (i.e., steeper declining

TABLE 4
Correlation Between Teacher Variable Amounts and Slopes

	TMEa	*TMEsl*	*TMIa*	*TMIsl*	*CMEa*	*CMEsl*	*CMIa*	*CMIsl*
TMEa	—							
TMEsl	–.88**	—						
TMIa	.062	–.068	—					
TMIsl	–.039	.045	–.99**	—				
CMEa	–.047	.069	–.053	.051	—			
CMEsl	.047	–.070	.053	–.051	–.99**	—		
CMIa	–.148	.137	–.026	.002	–.131	.131	—	
CMIsl	–.024	.020	.039	–.049	–.217	.217	.270	—
totLA	.235	–.234	.365*	–.378*	.084	–.084	.824*	.448*

Note. Hierarchical Linear Model Tau *r* provided for each variable's intercept/slope correlation. All others are Pearson correlations. a = teacher variable amounts; sl = slopes; TME = teacher-managed explicit; TMI = teacher-managed implicit; CME = child-managed explicit; CMI = child-managed implicit; totLA = total amount of Language Arts instruction.

*$p < .05$. **$p < .01$.

slopes), whereas teachers who provided smaller amounts of TME in the fall tended to provide smaller amounts all year long (i.e., flat slope). In contrast, there was no appreciable correlation between CMI instruction amount and slope ($r = .27$); there was no prevailing systematic pattern of CMI instruction among teachers over the school year. Some teachers provided higher or lower amounts of CMI all year long, some provided less as the year progressed, and others provided more.

Classroom Instruction Effects

Overall, classroom instruction had a complex effect on students' decoding skill growth. The results of hierarchical linear modeling are presented in Table 5. It should be noted that causal claims are beyond the scope of this study because we did not experimentally manipulate the type of instruction children received.

All instructional amount variables were included in the model at Level 2 for the intercept (β_0) to control for the total amount of language arts instruction provided. As noted previously, the length of the school day was the same for all classrooms, thus our model controlled for the total amount of language arts instruction (vs. other classroom activities). In other words, the effect of a particular type of instruction is controlling for the amount of all other types of instruction provided. Because all continuous variables were centered at the grand mean, the effect of a particular variable holds all other variables constant at their grand mean for the sample.

CMI slope was included in the model because it varied significantly by classroom. The fall Decoding × TME Amount, Decoding × CMI Amount, and Decoding × CMI Slope interactions were entered into the model at Level 2. The fall

Vocabulary × TME Amount, Vocabulary × CMI Amount, and Vocabulary × CMI Slope interactions were also entered into the model at Level 2.

Results of Hierarchical Linear Modeling

Type of instruction had a significant but complex effect on children's achievement, which was dependent on children's fall Vocabulary *and* Decoding scores (see Table 5). Overall, this model accounted for approximately 70% of the variance in children's spring reading decoding scores (Level 1 *r* variance in unconditional model = 231.60). There were significant main effects for children's fall vocabulary and fall decoding scores. Overall, children who began the school year with higher vocabulary and decoding scores tended to achieve higher spring decoding scores.

TABLE 5
Hierarchical Linear Model Results for the Instructional Variables' Effect on Spring Decoding Scores, Controlling for Mother's Educational Level and Home Literacy Environment Centered at the Grand Mean of the Sample

Fixed Effects	*Coefficient*	*SE*	*t-ratio*	*Approximate df*
For Intercept β_0				
Spring decoding, $\gamma 00$	39.71	.74	53.40	36
TME amount, $\gamma 01$	.06	.21	.30	
CME amount, $\gamma 02$	.60	.42	1.42	
TMI amount, $\gamma 03$	.20	.26	.77	
CMI amount, $\gamma 04$	.03	.11	.25	
CMI slope, $\gamma 05$	.52	.44	1.20	
MomEd, β_1, $\gamma 10$	.50	.37	1.34	41
Litscore, β_2, $\gamma 20$	–.01	.35	–.01	90
Fall decoding, β_3, $\gamma 30$	.88	.05	16.86***	90
TME Amount × Decoding, $\gamma 31$	–.02	.01	–2.08*	
CMI Amount × Decoding, $\gamma 32$	–.002	.01	–.17	
CMI Slope × Decoding, $\gamma 33$	.06	.05	1.27	
Fall vocabulary, β_4, $\gamma 40$	.14	.07	1.98*	90
TME Amount × Vocabulary, $\gamma 41$	–.002	.01	–.19	
CMI Amount × Vocabulary, $\gamma 42$	.02	.01	3.23**	
CMI Slope × Vocabulary, $\gamma 43$	–.11	.04	–2.64**	
Random Effects	*Variance*	*df*	χ^2	
Intercept, U_0	1.0	17	25.51****	
MomEd, U_1	.57	22	33.95*	
Level 1, r	69.40			

Note. Deviance = 758.75. Amount is in minutes/day and change over the course of the school year. Slope is in minutes change per month, centered at the mean. TME = teacher-managed explicit; CME = child-managed explicit; TMI = teacher-=managed implicit; CMI = child-managed implicit; MomEd = mother's educational level; Litscore = home literacy environment,

*$p < .05$. **$p < .01$. ***$p < .001$. ****$p < .10$.

There were no significant main effects for TME, TMI, CME, or CMI amounts or CMI slope on spring decoding scores (i.e., nonsignificant coefficients γ_{01}, γ_{02}, γ_{03}, γ_{04}, γ_{05}). However, there were significant interactions between type of instruction and fall vocabulary and decoding scores. TME interacted negatively and significantly with children's fall decoding score (i.e., coefficient γ_{31}), controlling for the other variables. CMI amount interacted positively and CMI slope interacted negatively with children's fall vocabulary scores (i.e., coefficients γ_{42} and γ_{43}, respectively). These interactions are presented in Figure 2. Mother's educational level and home literacy score did not significantly affect spring decoding scores (i.e., coefficients γ_{10} and γ_{20}, respectively).

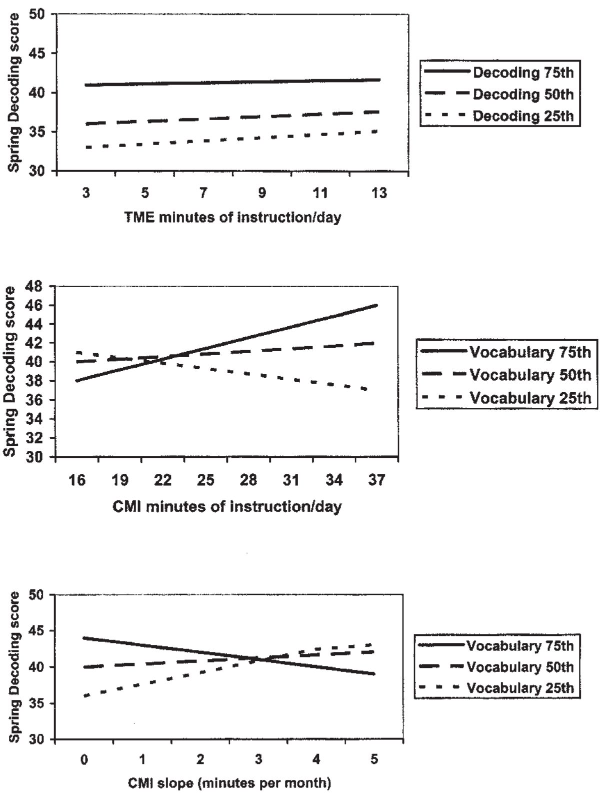

FIGURE 2 Child Skill × Instruction Type interaction effect for spring decoding raw scores. Top: Child fall decoding raw score (25th, 50th, and 75th percentiles of the sample) by TME amount holding child fall vocabulary raw score constant at the mean for the sample. Middle: Child fall vocabulary raw score (25th, 50th, and 75th percentiles of the sample) by CMI amount. Bottom: CMI slope holding child fall decoding raw score constant at the mean for the sample.

The results of our model generally supported our hypotheses. As noted, we found significant interactions between children's fall decoding score and TME amount but not for CMI. The reverse was the case for children's fall Vocabulary; interactions were significant for CMI amount and CMI slope but not for TME. We had expected parallel patterns because of the documented association between children's vocabulary and decoding skills (Anderson & Freebody, 1981; Scarborough, 1990). To investigate further, we computed the correlation between fall decoding and vocabulary and found it surprisingly low ($r = .26$, $p = .008$).

Our model indicated that instructional effects varied with *both* fall vocabulary and decoding levels simultaneously and independently; plus there was a main effect for fall vocabulary and fall decoding on spring decoding scores. Thus the association between amount of TME and CMI provided and children's decoding growth, according to our model, was independently affected by both their fall decoding and vocabulary skills. Therefore, we decided to investigate these complex effects further by computing the patterns of instruction associated with more versus less decoding skill growth for children with different patterns of fall vocabulary and decoding skill levels.

Because all of the variables in our model were continuous, there was an almost infinite number of potential child skill patterns and corresponding effects of patterns of instruction. To illustrate these interactions, we used our model to compute the effect of these interactions for four distinct child patterns of skills: (a) children with low fall vocabulary and decoding scores, which fell at the 25th percentile according to published norms (the raw scores representing the respective percentiles were selected using tables provided in the examiners' manuals); (b) children with high fall vocabulary and decoding scores, which fell at the 90th percentile; (c) children with low fall vocabulary (25th percentile) but high fall decoding (90th percentile); and (d) children with high fall vocabulary (90th percentile) but low fall decoding (25th percentile). The 25th and 90th percentiles were selected because they fell within the range of the data. Very few children in our sample had scores falling at the 10th percentile for either decoding or vocabulary. To do this, we used the raw score that, according to the norms, corresponded with the 25th and 90th percentile for first-grade students and entered it in to the model to compute the fitted spring Decoding outcome scores based on the varying patterns of instruction. These results are presented in Figures 3 through 6 and described next.

Low vocabulary/low decoding skills. For children whose fall vocabulary and decoding scores fell at the 25th percentile for published test norms ($n = 12$ within 1 standard error of measurement [SEM]), the model predicted significant main effects and interaction effects as displayed in Figure 3. For these children, fitted results demonstrated that they achieved greater growth in decoding scores in classrooms with more TME, whereas they achieved less growth in decoding scores with less TME (Figure 3). In addition, the more CMI instruction these children re-

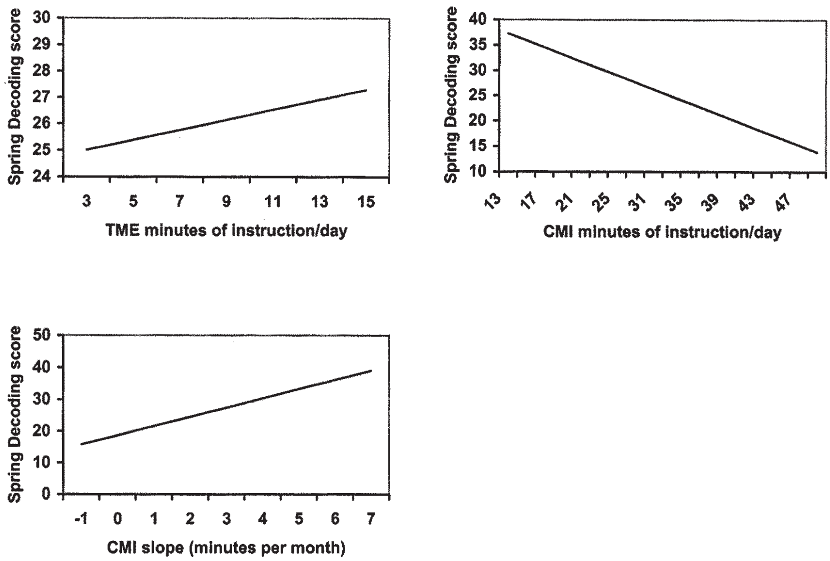

FIGURE 3 Effect of instruction (teacher-managed explicit [TME] and child-managed implicit [CMI] amount and slope [CMI change]) on children's spring decoding raw scores for children who began the school year with scores falling at the 25th percentile of standardized norms for fall vocabulary and decoding.

ceived in first grade, the less growth in Decoding they demonstrated. Yet the less CMI they received, the more growth in decoding they exhibited (Figure 3).

There was also a significant interaction with CMI slope for children with low fall vocabulary and decoding scores (Figure 3). Fitted results demonstrated that children achieved stronger growth in decoding in classrooms with less CMI in the fall but with increasing amounts through the spring of the school year (i.e., steep positive slope). In contrast, children achieved less growth in spring decoding scores in classrooms with steady amounts of CMI all year long (i.e., flat slope). Note that CMI amount and CMI slope were independent effects and so these effects were evident for classrooms with either high or low amounts of CMI. Nevertheless, fitted results indicated that low amounts of CMI in combination with a steep CMI slope (increasing amounts) was the pattern of instruction associated with greater decoding skill growth for these children.

High vocabulary/high decoding. For children whose fall vocabulary and decoding scores fell at the 90th percentile using published norms ($n = 8$ within 1 SEM plus 8 whose scores fell above the 90th percentiles for vocabulary and decoding), a contrasting pattern emerged, as displayed in Figure 4. For these children, fit-

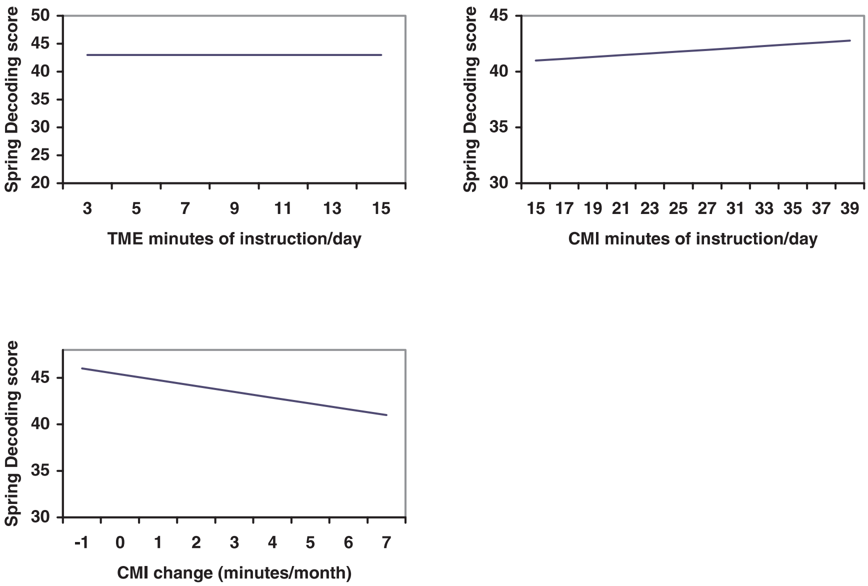

FIGURE 4 Effect of instruction (teacher-managed explicit [TME] and child-managed implicit [CMI] amount and slope [CMI change]) on children's spring decoding raw scores for children who began the school year with scores falling at the 90th percentile for fall vocabulary and decoding using standardized norms.

ted results revealed virtually no effect for amount of TME on their fall decoding scores (see Figure 4). However, when in classrooms with higher amounts of CMI, these children achieved greater growth in decoding scores by spring, whereas with lower amounts of CMI, they achieved less growth in decoding scores (see Figure 4). Here too, the effect of CMI slope had to be considered. For these children, a steady dose of more CMI all year long (i.e., flat slope) yielded more growth in decoding, whereas a steeper positive slope (i.e., less CMI in the fall increasing over the course of the school year) yielded less growth in decoding scores (see Figure 4).

Low vocabulary/high decoding. Only one child in our sample demonstrated scores that fit this profile—fall vocabulary scores at the 25th percentile but decoding scores at the 90th percentile ($n = 1$ within 1 SEM). Another child demonstrated observed scores that fell above the 90th percentile for decoding and below the 25th percentile for vocabulary. Thus, these results should be interpreted cautiously. Fitted results indicated that amount of TME had little effect on spring decoding scores (see Figure 5). Fitted results also demonstrated that when children received smaller amounts of CMI, they achieved stronger growth in spring decoding scores, whereas when they received higher amounts of CMI, they achieved less growth in spring decoding scores (see Figure 5). Further, children receiving increasing amounts of CMI over the school year (i.e., steep positive slope) achieved stronger growth in decoding scores by the spring. However, when they received steady amounts of CMI over the school year (i.e., flat slope) they achieved less growth in decoding scores (see Figure 5).

High vocabulary/low decoding. For children with fall vocabulary scores falling at the 90th percentile for published norms but decoding at the 25th percentile ($n = 10$ within 1 SEM), fitted results indicated that children in classrooms with higher amounts of TME achieved more growth in decoding scores. When they were in classrooms with lower amounts of TME, children achieved less growth in decoding scores (see Figure 6). Further, with higher amounts of CMI, children achieved stronger growth in decoding scores and with lower amounts of CMI, they achieved less growth (see Figure 6). For these children, a steady amount of CMI all year long (i.e., flat slope) yielded greater decoding score growth whereas lower amounts in the fall increasing over the school year yielded less growth in decoding scores (see Figure 6).

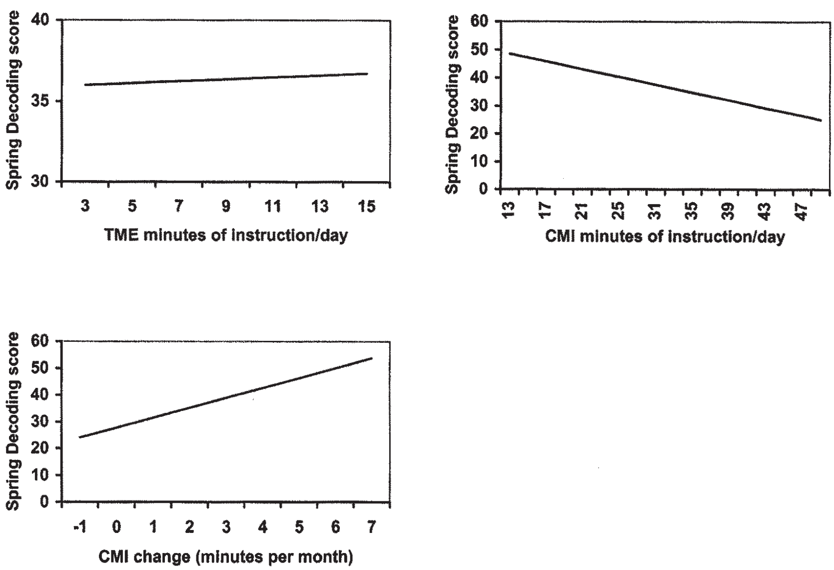

FIGURE 5 Effect of instruction (teacher-managed explicit [TME] and child-managed implicit [CMI] amount and slope [CMI change]) on children's spring decoding raw scores for children who began the school year with fall decoding scores falling at the 90th percentile but fall vocabulary falling at the 25th percentile using standardized norms.

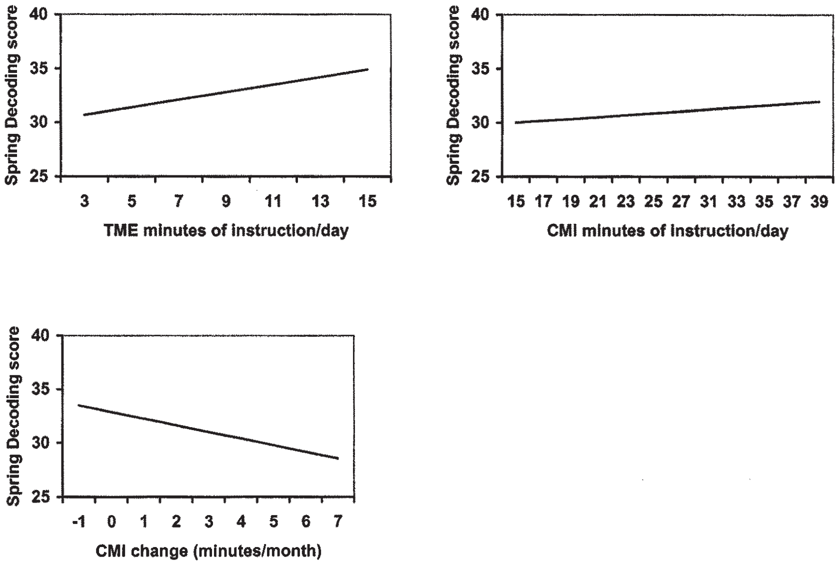

FIGURE 6 Effect of instruction (teacher-managed explicit [TME] and child-managed implicit [CMI] amount and slope [CMI change]) on children's spring Decoding raw scores for children who began the school year with fall decoding raw scores falling at the 25th percentile and fall vocabulary raw scores falling at the 90th percentile of standardized norms.

Cumulative Impact of Instructional Variables: Instruction Associated With Stronger Decoding Growth

The model can be used to elucidate the complex associations between child characteristics (i.e., fall vocabulary and decoding) and dimensions of instruction (i.e., TME amount, CMI amount, and CMI slope) and their combined effect on children's spring decoding scores. To this end, we estimated the patterns of instruction associated with stronger and weaker decoding growth for children in each of the four patterns of skills (i.e., low vocabulary/low decoding, etc.). Again, because the instructional variables were continuous, we chose values within the actual range of our data for amounts of TME and CMI as well as CMI slope—the 10th percentile and 90th percentiles of the sample (see Figures 7–10). Thus, meaningful values for both child characteristics and types of instruction (amount and slope) were entered into our model and the fitted spring decoding scores were computed. Note that although we use the term *more effective instruction* to describe patterns of instruction associated with stronger decoding score growth, we do not intend to imply causality. Moreover, the "causal effect" may go both ways—students respond to instruction *and* teachers modify instruction to accommodate the skills of their students. Addressing these issues is beyond the scope of this study.

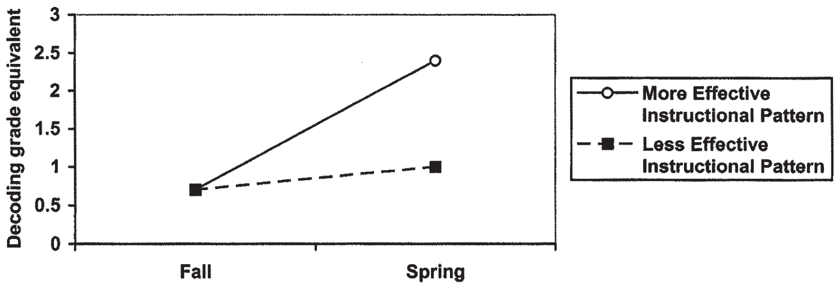

FIGURE 7 Effects of more and less effective patterns of instruction on spring decoding grade equivalent score for children who began the school year with low fall vocabulary raw scores (25th percentile standardized norms) and low fall decoding raw scores (25th percentile standardized norms).

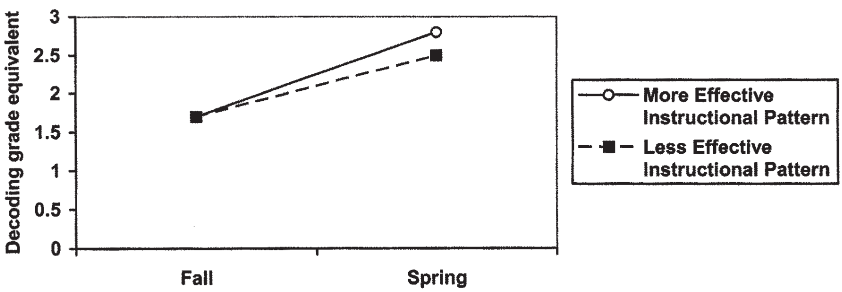

FIGURE 8 Effects of more and less effective patterns of instruction on spring decoding grade equivalent score for children who began the school year with high fall vocabulary (90th percentile standardized norms) and high fall decoding scores (90th percentile standardized norms).

For children with low fall vocabulary and decoding scores, the model indicated that a more effective pattern of instruction included higher amounts of TME (90th percentile for our sample) and smaller amounts of CMI (10th percentile for our sample) that increased over the school year (90th percentile for our sample). A less effective pattern of instruction included smaller amounts of TME (10th percentile for our sample) and greater amounts of CMI (90th percentile for our sample) all year long (slope at 10th percentile for our sample). As depicted in Figure 7, two children who started first grade with identical decoding scores (½ year below grade level, $n = 12$ within one SEM) showed dramatically different rates of decoding growth depending

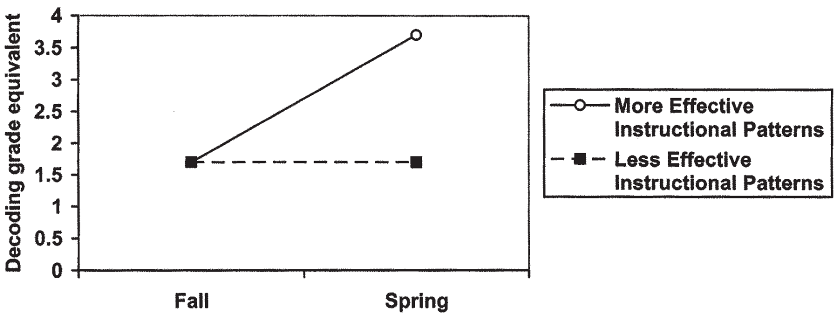

FIGURE 9 Effects of more and less effective patterns of instruction on spring decoding grade equivalent score for children who began the school year with low fall vocabulary (25th percentile standardized norms) and high fall decoding scores (90th percentile standardized norms).

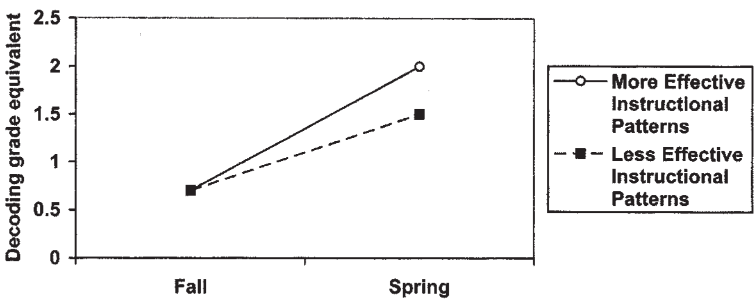

FIGURE 10 Effects of more and less effective patterns of instruction on spring decoding grade equivalent score for children who began the school year with high fall vocabulary (90th percentile standardized norms) and low fall decoding scores (25th percentile standardized norms).

on whether they received a more or less effective instructional pattern. As can be seen, one child exposed to a more effective instructional regime achieved a decoding score increase of almost two fitted grade equivalents. In contrast, the other child, receiving a less effective instructional pattern, demonstrated only limited growth in decoding scores or less than half a grade-equivalent. The children's fitted spring decoding scores differed by more than two grade-equivalents.

A contrasting pattern of effective instruction was revealed for children who had high fall vocabulary and decoding scores (see Figure 8, $n = 8$ within 1 SEM). For these children, instruction had a smaller effect overall; the difference between more and less effective patterns of instruction on children's spring decoding scores was less than half a grade-equivalent and children's scores improved over the school year even with the less effective pattern of instruction.

The model predicts substantial differences in achievement for more and less effective patterns of instruction for the other two groups of children (see Figures 9 and 10). More effective instruction for children who had low vocabulary and high decoding scores ($n = 2$) included lower amounts of TME and higher amounts of CMI all year long (i.e., flat slope). Contrasting more and less effective patterns of instruction revealed more than one grade equivalent difference in spring decoding (see Figure 9). For children who had high vocabulary and low decoding scores ($n = 10$ within one SEM), more effective instruction included higher amounts of TME and lower amounts of CMI that increased over the school year (i.e., steep positive slope). Comparing more and less effective patterns of instruction yielded a fitted grade equivalent difference of about one grade (see Figure 10).

DISCUSSION

The results of this study demonstrated that the effects of specific first-grade instructional practices on children's decoding skills depended in large part on children's entering vocabulary and decoding skills. Children came to first grade with varying language and literacy skills. Classroom instruction also varied in amount and included a mixture of code-based and meaning-based activities in differing proportions across classrooms, which were encompassed in three dimensions of instruction (explicit vs. implicit, teacher- vs. child-managed, and change).

Not surprisingly, children with weaker fall decoding skills achieved greater decoding skill growth in classrooms with more teacher-managed explicit decoding instruction (i.e., TME), whereas children with stronger decoding skills attained less decoding skill growth in the same classrooms. Children with stronger vocabularies achieved stronger decoding skill growth in classrooms with many opportunities for independent reading and writing activities (i.e., CMI) throughout the school year, whereas children with weaker vocabulary skills achieved stronger decoding skills when opportunities for independent reading and writing were kept to a minimum in the fall but were increased as the school year progressed. It is important to note that these effects occurred simultaneously. Because the correlation between fall vocabulary and decoding was weak, there were appreciable numbers of children with low decoding and high vocabulary skills, as well as a few children with high decoding and low vocabulary, in addition to those with high vocabulary and high decoding, or low vocabulary and low decoding. Fitted results indicated that depending on children's decoding and vocabulary skills, different but predictable patterns of instruction were associated with stronger decoding skill growth. For example, children with low fall decoding skills and high fall vocabulary skills achieved greater decoding skill growth in classrooms with more time spent in TME and high amounts of CMI all year long.

Dimensions of Instruction

Overall, the coding scheme used in this study proved fruitful in identifying dimensions of instruction (explicit vs. implicit, teacher- vs. child-managed, and change in amount over time) that varied among classrooms and that predicted growth in decoding. The variables appeared to capture important elements of literacy instruction within both code-based and meaning-based philosophies and provided a way to quantify and compare them. In general, the pattern of findings supported aspects of both sides in the reading wars, but instructional effects differed for children with differing skills.

It is notable that systematic changes in focus of instruction over the course of the school year were apparent for this group of teachers. Overall, teachers focused more on directly instructing basic decoding skills (i.e., TME instruction) at the beginning of the year but decreased this emphasis as the year progressed and, presumably, as children's decoding skills improved. This pattern of decreasing amounts of TME over time was consistent among teachers. In contrast, overall, CMI instruction increased in amount over the school year but varied significantly among teachers. This suggests that teachers may have been responding to children's increasing independence as they learned classroom routines and better managed their own learning as the school year progressed.

Two types of instruction, teacher-managed implicit decoding instruction (TMI) and child-managed explicit decoding instruction (CME), had no significant effect on children's decoding skill growth. Overall, in the observed classrooms, there was little language arts time devoted to CME activities, such as phonics workbooks or alphabet worksheets. Thus this study cannot speak to the effect of such activities on children's decoding skill growth. TMI activities, such as discussions about books and teachers reading to the students, did not appear to have a systematic effect on children's decoding skill growth. However, such activities may be important for children's reading comprehension growth and emerging attitudes toward reading; more study is needed.

Conceptualizing instructional practices using dimensions of instruction provided flexibility coupled with a fine-grained yet quantifiable view of classroom activities. This allowed us to model the complex instructional patterns observed as well as their interaction with child characteristics as they affected child outcomes. This would not have been possible had we defined instruction one-dimensionally. Further, dimensions of instruction were specific to the outcome of interest. Had reading comprehension rather than decoding been the outcome of interest, the dimension of explicit versus implicit would have changed substantially. Given the high degree of specificity observed for schooling effects (Christian et al., 2000) it is reasonable to infer that explicit decoding instruction would have had an indirect impact on children's reading comprehension growth. Rather, instructional activities explicitly focusing on reading comprehension (Palincsar & Brown, 1984; Wixson, 1983) might be expected to have a greater effect.

Child Factors

The skills with which children began first grade had a direct and important effect on their decoding skill growth. Overall, the effect of these child factors was greater than the effect of classroom instruction practices and directly influenced the strength of the instruction effects. Classroom instruction had a much greater influence, either positively or negatively, for children who began first grade with weaker vocabulary and decoding skills than it did for children with stronger skills. As can be seen by comparing Figures 7 and 8, the potential difference in decoding growth between more and less effective patterns of instruction was about half a grade equivalent for children with high fall vocabulary and decoding skills but more than two full grade equivalents for children with low fall vocabulary and decoding skills. Children who began the year with stronger vocabulary and decoding skills achieved some decoding skill growth almost regardless of classroom instructional practices. Strong decoding and vocabulary skills may have acted to offset the negative effects of less effective instructional practices and provided a path of resilience (Werner, 2000) not available for children with weaker skills. Teacher's instructional practices had a greater effect—both positive and negative—for the children who lacked these apparent protective factors. Children whose decoding skills were below grade level remained below grade level in the face of poorly fitting instructional patterns.

The interaction between children's fall vocabulary and CMI amount and slope underscore the association between oral language and reading skills. The relation between vocabulary and reading skills has been well documented (Anderson & Freebody, 1981; Scarborough, 1990). However, the interaction between vocabulary and CMI instruction is intriguing and deserves further study. We speculate that stronger vocabulary skills may support children's implicit decoding learning because they have a greater repertoire of words to rely on when they encounter unknown words. Further, there is a documented association between vocabulary and phonological awareness (Foy & Mann, 2001; Gathercole & Baddeley, 1989; Metsala, 1991). Thus children with strong vocabularies may have greater access to more effective word-attack strategies (Stanovich, 1980).

Although this study focuses on vocabulary and decoding, there are clearly other child characteristics that may influence children's achievement and interact with instructional activities, including phonological awareness skills, other oral language skills, and self-regulation. In addition, the child factors of interest may vary when the literacy outcome is fluency, comprehension, or writing skills. All merit further study.

Research Implications

From the foregoing discussion, it is evident that at the level of the individual child, instructional activities and patterns that are considered high quality for one child may be considered poor quality for another. Substantial amounts of CMI (or meaning-based instruction) for a child with strong vocabulary skills may be associated with stronger decoding gains, whereas the same amount of CMI for a child with weaker vocabulary skills may be associated with substantially less progress. On a broader level, our findings suggest that the effort to define and search for "quality" in instructional environments may be somewhat misdirected. By focusing our efforts toward identifying those instructional variables that emerge as causally relevant in the classroom environment (amount, type, and change) and how they interact with child characteristics, we can more accurately identify "high-quality" or, rather, *effective* instruction for individual children.

This study demonstrated the usefulness of classroom observation and the coding system utilized for quantifying the nature and specificity of instructional effects. Transcription and coding of the classroom observations yielded indices of the absolute and proportional amounts of instructional time devoted to various language arts activities (e.g., word decoding, initial consonant stripping, sustained silent reading for language arts) as well as changes in amount provided over the school year. These continuous multidimensional variables provided a more informative view of classroom instructional activities than would have been available using categorical or one-dimensional variables. However, there are clearly other dimensions of instruction that may be important to consider. For example, teacher-managed instruction may be whole-class, small group, or individual, and our dimensions did not capture this difference. Further, there may be differences in outcomes for child-managed instruction that encompasses working with peers compared to children working individually. In addition, there is a documented association between teacher warmth and responsiveness to their students and student achievement (deKruif, McWilliam, & Ridley, 2000; Mahoney & Wheeden, 1999). Further, teachers' ability to manage their classrooms is associated with children's learning (Brophy & Good, 1986; Taylor et al., 2000). Teacher warmth-responsivity and teacher control-discipline are dimensions that should be studied further.

The interaction between child characteristics and patterns of instruction suggests that classroom instruction may be more effectively studied at multiple levels considering both classroom practices and the characteristics of the children in the classroom. Further, more distal sources of influence, such as school district policy and community expectations, may well affect classroom instruction efficacy. Taylor et al. (2000) observed that school policies, atmosphere, beliefs, and reform efforts affected what happened in the classroom. This effect was apparent in this study as well. Overall, as noted previously the school district in this study supported a whole-language approach to teaching reading and encouraged teachers to provide significant amounts of sustained silent reading time for their students. The effect was evident when we compared the mean amount of TME provided (7.4 min per day) with the mean amount of CMI provided (28.5 min per day). The ramification for children who began school with low decoding and vocabulary skills was that they were less likely to be in classrooms with patterns of instruction that were effective for them. However, children with high fall decoding and vocabulary skills were more likely to be in classrooms that were effective for them. Not surprisingly, the school district had a documented achievement gap that increased as children progressed through school (i.e., a Mathew Effect; Stanovich, 1986).

These results highlight the value of bringing an ecological approach to the study of children's development and the multiple sources of influence—proximal, distal, and chronological—that directly and indirectly impact children's literacy learning (Bronfenbrenner, 1986). Observing and modeling classrooms as complex systems subject to proximal (children, teachers, and instructional practices) and distal sources of influence (home, school, and community) and changes in these influences over time, may better inform our understanding of instruction and how best to serve all students.

Implications for Classroom Practice

A central implication of these findings is that appropriate amounts of individualized instruction can lead to significant decoding skill growth. Indeed, in other studies of instruction, researchers observed that the most effective teachers provided additional explicit instruction in basic decoding skills to those children who needed it (Wharton-McDonald et al., 1998). The dilemma, of course, is that individualizing instruction inserts a level of complexity into designing and implementing effective classroom practices, especially if teachers' classrooms include many students with very different skill levels. Yet, by understanding which instructional activities are most effective in promoting children's skill growth and in what amounts over the school year, teachers can become more mindful of the effect of their instructional practices. For example, early in the school year, teachers may ask their students with strong vocabulary and decoding skills to read or write independently (CMI) while they provide explicit decoding instruction (TME) to children with weaker decoding and vocabulary skills.

Although a thorough discussion of specific classroom strategies is beyond the scope of this article, use of flexible small student groups based on such assessments of student abilities may approximate the kind of individualized instruction that will optimize each child's learning. Further, there is good evidence that how teachers interact with their students affects student achievement (e.g., scaffolding–coaching vs. telling; Taylor et al., 2000). Clearly, to provide individualized instruction, teachers need to have some idea of the initial skill level of their students. Here another important educational implication of our findings is that systematic assessment of children's ability levels in important language and literacy skills should be a routine part of each year's classroom practices. Initial assessments during early fall should be complemented by ongoing testing during the school year to monitor progress and adjust instruction accordingly (Juel & Minden-Cupp, 2000; Rayner et al., 2001; Taylor et al., 2000; Westat, 2001; Wharton-McDonald et al., 1998).

In summary, the results of this study highlight the importance of understanding interactions between the skills that children bring to school and the instructional strategies they encounter in the classroom. These findings indicate that appropriately targeted instructional strategies can have a dramatic impact on growth of children's early reading skills and their prospects for academic success.

ACKNOWLEDGMENTS

Carol McDonald Connor is now with the College of Education at Florida State University and the Florida Center for Reading Research. Funding for this study was provided by the National Institute of Child Health and Human Development Grant R01 HD27176.

We thank Steve Raudenbush for his consultation regarding the analyses used in this study. We also thank Seung-Hee Son, Elizabeth Griffin, and members of the University of Michigan and Loyola projects as well as the parents, children, teachers, and school district personnel without whom this study would not have been possible.

REFERENCES

Adams, M. J. (1990). *Beginning to read: Thinking and learning about print*. Cambridge, MA: MIT Press.

Anderson, R. C., & Freebody, P. (1981). Vocabulary knowledge. In J. T. Guthrie (Ed.), *Comprehension and teaching: Research reviews* (pp. 77–117). Newark, DE: International Reading Association.

Bredekemp, S., & Copple, C. (Eds.). (1997). *Developmentally appropriate practice in early childhood programs*. Washington, DC: National Association for the Education of Young Children.

Bronfenbrenner, U. (1986). Ecology of the family as a context for human development: Research perspectives. *Developmental Psychology, 22*, 723–742.

Brophy, J. E., & Good, T. L. (1986). Teacher behavior and student achievement. In M. C. Wittrock (Ed.), *Handbook of research on teaching* (3rd ed., pp. 328–375). New York: Macmillan.

Catts, H. W., Fey, M. E., Zhang, X., & Tomblin, J. B. (2001). Estimating the risk of future reading difficulties in kindergarten children: A research-based model and its clinical implementation. *Language, Speech, and Hearing Services in Schools, 32*, 38–50.

Christian, K., Morrison, F. J., Frazier, J., & Masseti, G. (2000). Specificity in the nature and timing of cognitive growth in kindergarten and first grade. *Journal of Cognition and Development, 1,* 429–449.

Connor, C. M., Morrison, F. J., & Griffin, E. (2002). *Measuring classroom instruction*. Unpublished technical report, University of Michigan Pathways to Literacy Project, Ann Arbor, MI. (Available from pathwaystoliteracy@umich.edu)

Cunningham, A., & Stanovich, K. (1997). Early reading acquisition and its relation to reading experience and ability 10 years later. *Developmental Psychology, 33,* 934–945.

Cunningham, A., Stanovich, K., & West, R. (1994). Literacy environment and the development of children's cognitive skills. In E. Assink (Ed.), *Literacy acquisition and social context.* (pp. 70–90). London: Wheatsheaf/Prentice Hall.

Cunningham, P., & Hall, D. (1998). The four blocks: A balanced framework for literacy in primary classrooms. In K. R. Harris, S. Graham & D. Deshler (Eds.), *Teaching every child every day: Learning in diverse schools and classrooms* (pp. 32–76). Cambridge, MA: Brookline.

Dahl, K. L., & Freppon, P. A. (1995). A comparison of innercity children's interpretations of reading and writing instruction in the early grades in skills-based and whole language classrooms. *Reading Research Quarterly, 30*(1), 50–74.

deKruif, R. E. L., McWilliam, R. A., & Ridley, S. M. (2000). Classification of teachers' interaction behaviors in early childhood classrooms. *Early Childhood Research Quarterly, 15,* 247–268.

Dickinson, D. K., & Tabors, P. O. (2001). *Beginning literacy with language*. Baltimore: Brookes.

Dunn, L., & Dunn, L. (1987). *Peabody Picture Vocabulary Test–Revised*. Circle Pines, MN: American Guidance Service.

Entwisle, D. R., & Alexander, K. L. (1988). Factors affecting achievement test scores and marks of black and white first graders. *The Elementary School Journal, 88*, 449–472.

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

Foy, J. G., & Mann, V. (2001). Does strength of phonological representations predict phonological awareness in preschool children? *Applied Psycholinguistics, 22*, 301–325.

Gathercole, S. E., & Baddeley, A. D. (1989). Evaluation of the role of phonological STM in the development of vocabulary in children: A longitudinal study. *Journal of Memory and Language, 28*, 200–213.

Goodman, K. (1970). Reading: A psycholinguistic guessing game. In H. Singer & R. B. Ruddell (Eds.), *Theoretical models and processes of reading* (pp. 259–272). Newark, DE: International Reading Association.

Griffin, E., & 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.

Guthrie, J. T., Schafer, W. D., & Huang, C.-w. (2001). Benefits of opportunity to read and balanced instruction on the NAEP. *Journal of Educational Research, 94*(3), 145–162.

Hart, B., & Risley, T. R. (1995). *Meaningful differences in the everyday experience of young American children*. Baltimore: Brookes.

Hiebert, E. H., & Raphael, T. E. (1998). *Early reading instruction*. New York: Harcourt Brace.

Juel, C., & Minden-Cupp, C. (1998). *Learning to read words: Linguistic units and strategies*. Ann Arbor, MI: Center for the Improvement of Early Reading Achievement.

Juel, C., & Minden-Cupp, C. (2000). Learning to read words: Linguistic units and instructional strategies. *Reading Research Quarterly, 35,* 498–492.

Locke, J. L. (1993). *The child's path to spoken language*. Cambridge, MA: Harvard University Press.

Locke, J. (1997). A theory of neurolinguistic development. *Brain and Language, 58*, 265–326.

Mahoney, G., & Wheeden, A. C. (1999). The effect of teacher style on interactive engagement of preschool-aged children with special learning needs. *Early Childhood Research Quarterly, 14*(1), 51–68.

Markwardt, F. C. (1989). *Peabody Individual Achievement Test–Revised*. Circle Pines, MN: American Guidance Service.

Metsala, J. (1991). Young children's phonological awareness and nonword repetition as a function of vocabulary development. *Journal of Educational Psychology, 91*(1), 3–19.

Morrison, F., & Cooney, R. (2002). Parenting and academic achievement: Multiple paths to early literacy. In M. Bristol-Power (Ed.), *Parenting and the child's world: Influences on academic, intellectual, and social-emotional development* (pp. 141–160). Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

Morrison, F. J., Smith, L., & Dow-Ehrensberger, M. (1995). Education and cognitive development: A natural experiment. *Developmental Psychology, 31,* 789–799.

National Assessment of Educational Progress. (2000). *U.S. Department of Education*. Washington, DC: National Center for Educational Statistics.

Neuman, S. B., & Dickinson, D. K. (2001). *Handbook of early literacy research*. New York: Guilford.

Nippold, M. (Ed.). (1988). *Later Language Development*. Boston: College Hill.

National Reading Panel. (2000). *Teaching children to read: An evidence-based assessment of the scientific literature on reading and its implications for reading instruction* (Summary). Washington, DC: Author.
Palincsar, A. S., & Brown, A. L. (1984). Reciprocal teaching of comprehension-fostering and monitoring activities. *Cognition and Instruction, 1*, 117–175.
Pressley, M. (1998). *Reading instruction that works: The case for balanced teaching*. New York: Guilford.
Raudenbush, S. W., & Bryk, A. S. (2002). *Hierarchical linear models: Applications and data analysis methods* (2nd ed.). Thousand Oaks, CA: Sage.
Ravitch, D. (2001). It is time to stop the war. In T. Loveless (Ed.), *The great curriculum debate: How should we teach reading and math* (pp. 210–228). Washington, DC: Brookings Institutional Press.
Rayner, K., Foorman, B. R., Perfetti, C. A., Pesetsky, D., & Seidenberg, M. S. (2001). How psychological science informs the teaching of reading. *Psychological Science in the Public Interest, 2*(2), 31–74.
Scarborough, H. S. (1990). Very early language deficits in dyslexic children. *Child Development, 61*, 1728–1743.
Snow, C. E., Burns, M. S., & Griffin, P. (Eds.). (1998). *Preventing reading difficulties in young children*. Washington, DC: National Academy Press.
Stanovich, K. E. (1980). Towards an interactive-compensatory model of individual differences in the development of reading fluency. *Reading Research Quarterly, XVI*, 32–71.
Stanovich, K. E. (1986). Matthew effects in reading: some consequences of individual differences in the acquisition of literacy. *Reading Research Quarterly, 21*, 360–407.
Sternberg, R. J. (1996). Matching abilities, instruction, and assessment: Reawakening the sleeping giant of ATI. In I. Dennis (Ed.), *Human abilities: Their nature and measurement* (pp. 167–181). Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.
Stevenson, H., Parker, T., Wilkinson, A., Hegion, A., & Fish, E. (1976). Longitudinal study of individual differences in cognitive development and scholastic achievement. *Journal of Educational Psychology, 68,* 377–400.
Stipek, D. J., & Ryan, R. H. (1997). Economically disadvantaged preschoolers: Ready to learn but further to go. *Developmental Psychology, 33,* 711–723.
Taylor, B. M., Pearson, D. P., Clark, K., & Walpole, S. (2000). Effective schools and accomplished teachers: lessons about primary-grade reading instruction in low-income schools. *The Elementary School Journal, 101*(2), 121–165.
Thorndike, R. L., Hagen, E. P., & Sattler, J. M. (1986). *Stanford-Binet Intelligence Scale* (4th ed.). Chicago: Riverside.
Torgesen, J. K., Alexander, A. W., Wagner, R. K., Rashotte, C. A., Voelier, K. K. S., & Conway, T. (2001). Intensive remedial instruction for children with severe reading disabilities: Immediate and long-term outcomes from two instructional approaches. *Journal of Learning Disabilities, 34,* 33–58.
Werner, E. E. (2000). Protective factors and individual resilience. In J. P. Shonkoff & S. J. Meisels (Eds.), *Handbook of early childhood intervention: 2nd edition*. New York: Cambridge University Press.
Westat. (2001). *The longitudinal evaluation of school change and performance in Title 1 schools: Final report* (No. 2001–20). Washington, DC: U.S. Department of Education.
Wharton-McDonald, R., Pressley, M., & Hampston, J. M. (1998). Literacy instruction in nine first-grade classrooms: Teacher characteristics and student achievement. *The Elementary School Journal, 99*(2), 101–128.
Wixson, K. K. (1983). Postreading question-answer interactions and children's learning from text. *Journal of Educational Psychology, 30,* 413–423.

Manuscript received November 7, 2002
Accepted August 22, 2003

APPENDIX

Coding Scheme for Classroom Observations

Language Arts: Time spent (number of minutes) engaged in activities that require reading, writing, or reading/writing related things but that are *not* focused on gaining information about another content area (science, social studies, math, drama, etc.).

a. Teacher read aloud: The teacher reads from a picture book, a chapter book, or magazine, etc.; provides a book-on-tape for the children to listen to; or shows a video wherein a story is presented.
b. Student read aloud, individual: A single child reads aloud, in a small group or whole class, from a picture book, chapter book, magazine, or own writing.
c. Student read aloud, choral: More than one child reads aloud from picture book, chapter book, magazine, poster, etc.
d. SSR (silent sustained reading): Children sit quietly and read to themselves
e. Teacher-managed group writing: The teacher is at blackboard–easel, working with children on a group writing activity. Children offer the content of the written piece but the teacher puts the ideas into complete sentences, with appropriate punctuation, etc.
f. Writing instruction: The teacher tells the children how to do things that will help them to become independent writers, such as how to engage in advanced organizing (e.g., webbing, outlining), how to move from outline to written product, how to proofread, and edit. This also includes instruction in the different forms of writing (expository versus demonstration, etc.).
g. Teacher model writing: The teacher, without input from the children, stands at the blackboard–easel and produces some sort of written product (depending on the level of the students, it could be as small as a sentence). The intent of the writing must be to model the act of writing and an appropriate product.
h. Student group writing: The children are working in pairs or small groups to produce a written product (such as a story). Not all of the children will actually be doing the writing, but should be engaged in discussions about what will be written.
i. Student independent writing: Children are quietly writing a story, poem, or journal entry by themselves.
j. Spelling: Children are taking a spelling test or copying or practicing spelling words.
k. Discussion: Children are reviewing a storyline from a book the teacher has been reading aloud (just prior to the teacher continuing with her reading), or previewing a book the teacher is about to read. Children are responding to questions that go beyond simple comprehension.

l. Reading comprehension activity: Children are completing worksheets related to material they have read, or are writing in response to something they have read.
m. Listening comprehension: Children respond to questions about material teacher is reading to them presently, such as who is the main character, or what just happened.
n. Alphabet activity: Children are engaged in work that focuses their attention on a particular letter of the alphabet. For example, they might have to make a letter out of clay, color a paper that shows a particular letter and items that begin with that letter, or put their body in the shape of a letter.
o. Letter sight–sound: Children are engaged in activities that focus their attention on the relationship between written form of *individual* letters and the sound those letters represent. Included here are activities such as "signs for sounds" wherein the teacher orally produces a single letter sound, and the children circle the letter (from an array of letters on a prepared paper) that represents that sound. This subactivity must combine the written form and oral sounds that represent the written form. If no written form is used, then the activity is more appropriately coded as initial consonant stripping or word segmentation.
p. Initial consonant stripping: Children are identifying the beginning (initial) consonant sound of words, aurally and not visually. If the activity is visual *and* aural, then code the activity as letter sight–sound. Additionally, if the initial sound is a vowel and only orally presented, then code the activity as word segmentation.
q. Word segmentation: Children are engaged in activities wherein they break words into subcomponents (syllables, sub-syllables or phonemes), orally; or they are charged with constructing whole words from orally presented word segments. Included here are activities such as learning word families (children are presented with a rime, and must find onsets that make real words; this is often an oral–written activity, but the initial response is oral). For an activity to be coded as word segmentation rather than letter sight–sound, the intent of the activity should be at the word level and not the letter level.
r. Vocabulary: The teacher and/or children are discussing the meaning of a word or a phrase. This is a rarely used code, primarily because word-definition discussions rarely last the minimum 1-min interval.
s. Conventions of print: The children are engaged in activities focused on grammar or punctuation. Included here are activities such as "Daily Oral Language" wherein children have to correct the errors in a sentence that the teacher has written on the blackboard.