

ABSTRACT

WEISS, STACY LYNN. Early Elementary School Predictors of a Learning Disability in Reading. (Under the direction of Cathy Crossland and Barbara Fox).

The purpose of this study was to determine if four kindergarten factors were predictive of the identification of a learning disability with Individual Education Program goals in reading (LDR) at third and fifth grades. Much of the research related to predicting reading difficulty has focused on early elementary school outcomes and included predictors from only one domain, such as reading-related skills (Scarborough, 1998). This study extends the research by combining four factors related to LDR identification into a single study: student age on the first day of kindergarten, social-academic behaviors in the classroom, reading skills, and reading instruction in the sound-symbol relationship. Data from the Early Childhood Longitudinal Study-Kindergarten cohort (ECLS-K) were analyzed using logit analyses. Odds, confidence intervals, and probabilities of LDR identification are presented to aid in the interpretation of the results.

Student age on the first day of kindergarten, social-academic behaviors, and reading scores were significant predictors of LDR. Being significantly older in kindergarten (two standard deviations above the mean), having significantly lower teacher ratings of social-academic behaviors (two standard deviations below the mean) and scoring significantly lower on a standardized reading measure (two standard deviations below the mean) resulted in a probability of LDR identification at third grade of .76 and a probability of LDR identification at fifth grade of .64, when including all students. When only considering the students who were in kindergarten for the first time at the beginning of the study, age at time of kindergarten entry, social-academic behaviors, and reading scores continued to be significant predictors of LDR at third grade. At fifth grade, reading and social-academic behaviors independently were significant predictors of LDR.

The frequency of kindergarten instruction in the sound-symbol relationship was not a significant predictor of LDR at third or fifth grades. Kindergarten teachers reported similar and frequent instruction related to matching letters to sounds, working on phonics, and identifying letters of the alphabet. Additional research is needed to determine if other instruction-related factors such as intensity or method of instruction are significant predictors of LDR. Study limitations and areas for additional research based on these findings are discussed.

Scarborough, H. S. (1998). Early identification of children at risk for reading disabilities:

Phonological awareness and some other promising predictors. In B. K. Shapiro, P. J. Accardo, & A. J. Capute (Eds.) *Specific reading disability: A view of the spectrum* (pp.75-119). Timonium, MD: York Press, INC.

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Early Elementary School Predictors of a Learning Disability in Reading

by
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A dissertation submitted to the Graduate Faculty of
North Carolina State University
In partial fulfillment of the
Requirements for the degree of
Doctor of Philosophy

Curriculum and Instruction

Raleigh, North Carolina

2008

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ACKNOWLEDGEMENTS

I have had the great fortune of working with a superb committee: Dr. Cathy Crossland, Dr. Barbara Fox, Dr. Edward Sabornie, and Dr. Lynne Baker-Ward. I would like to thank them for their time, encouragement, guidance, and inspiration. A special thanks to Cathy Crossland for her immeasurable assistance, and her time and commitment in helping me meet my goals throughout graduate school. I would especially like to thank Barbara Fox for all of her encouragement with my research and her advice when considering the big picture. I wish to thank Ed Sabornie for the valuable opportunities I have had in graduate school and for sharing his perspective and insight. I am grateful to Lynne Baker-Ward for challenging my thinking and for always setting high expectations.

I cannot begin to express how grateful I am to my husband, Joe, for his patience and support during all these years in graduate school. I have appreciated all of our discussions about education, dissertation, and life on our late-night walks. I would also like to thank my family for inspiring me, teaching me to be persistent, and supporting me along the way.

I also want to thank Scott Lennon, Matt Ronning, and Joe Rabiega at North Carolina State University for their assistance with securing the restricted release data license and navigating the Institutional Review Board. Thanks also go to the helpful staff associated with the ECLS-K data set at the National Center for Education Statistics and American Institute for Research.

This research was supported by a dissertation award from the College of Education at North Carolina State University.

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CHAPTER 1 – INTRODUCTION

Students with school-identified learning disabilities (LD) comprise approximately six percent of the pre-kindergarten to twelfth grade public school population in the United States (US Department of Education [USDE], 2006). Students with learning disabilities are often not identified until mid- to late elementary school and frequently experience a period of failure with learning to read before receiving specific and individualized services (Horowitz, Kaloi, & Petroff, 2007; McCardle, Scarborough, & Catts, 2001). The current guidelines of No Child Left Behind (NCLB) require that by the 2013-2014 school year all third grade students, including those with disabilities, be proficient readers (2001). Unless there is dramatic improvement in the process of identifying and serving young children at risk for reading difficulties, there will continue to be a significant number of students unable to meet this goal.

Early identification processes and early intervention programs are critical because positive outcomes are more difficult and more costly as students get older (Fuchs & Fuchs, 2006; Heckman, 2000). The effects of early reading difficulties are evident throughout an individual's lifespan. Many adults with LD continue to experience difficulty with completing daily living activities, maintaining social relationships, and living independently (Butler, 2004).

Early, intensive reading intervention can be effective for many students at risk for later reading problems (Torgesen, 2002). However, it is often difficult to (a) identify the students who are most in need of early intervention services (McCardle et al., 2001) and (b) predict later reading difficulty (Scarborough, 1998; Snow, Burns, & Griffin, 1998) using only kindergarten cognition and reading-related skills. To date, there is limited research on the specific early childhood factors that can be directly linked to the likelihood that a student will subsequently be identified with LD (Horowitz et al., 2007). Part of the difficulty in determining early elementary school indicators of

later LD identification may be related to the challenges and controversy of operationally defining LD (Fletcher, Lyon, Fuchs, & Barnes, 2007; Gaskins, 1982; Kavale & Forness, 2000; Speece & Shekikta, 2002).

By focusing on public schools' application of the federal guidelines of the Individuals with Disabilities Education Act (IDEA; 1997),¹ it is possible to identify students whose schools and parents have agreed that the students' reading needs cannot be met by the standard general education curriculum alone. The provision of services through an Individual Education Program (IEP) for a learning disability with goals in reading (LDR) leads to the assumption that these students share a common and significant difficulty in learning to read. State variations in LD classification procedures (Reschly & Hosp, 2004) and possible co-morbid conditions or other areas of LD identification (Fletcher et al., 2007) add to the heterogeneity found in the LDR population, which may influence the understanding of predictors of LDR. However, prevalence rates of LD have remained stable over time and compared to other disability classifications, the LD category has the least variability in prevalence rates among states (Hallahan et al., 2007).

Reading-related skills, such as the ability to name the letters of the alphabet, identify print concepts, isolate individual sounds within words, and rapidly name objects, letters or numbers are predictive of later reading achievement (Scarborough, 1998; Snow et al., 1998); however, these early literacy skills alone are not enough to accurately predict which students will have significant difficulty learning to read in later elementary school. Focusing solely on academic factors ignores other essential aspects of a child's development (Southern Regional Educational Board, 1994) that may influence the identification of LD. Therefore, it is necessary to expand the investigation of

¹ This study conducted an analysis of data from the Early Childhood Longitudinal Study-Kindergarten Cohort (ECLS-K). The 1997 IDEA provisions were in effect at the time the students involved in the ECLS-K study were in the third and fifth grades.

factors that play a role in predicting student outcomes and in particular school identification of a learning disability.

Statement of Problem

In order to understand a child's development and learning, it is important to consider the bi-directional influence that a child's immediate environment (microsystem) and individual characteristics have on each other (Bronfenbrenner, 1979). Special education studies often focus on LD as a deficit in intrinsic factors (e.g. verbal skills) or external factors (e.g. poor teaching) (Kavale & Forness, 1986). Instead, Kavale and Forness argue that LD should be conceptualized in terms of an interaction between the internal and external factors as they relate to academic learning time. Students with LD may be in classroom situations in which there is a mismatch between the amount of time they need to learn (internal factors) and the amount of time they actually receive instruction (external factors). As a result, there is a lack of goodness-of-fit between the child and his/her environment. Two children in the same setting may have different outcomes as a result of the interaction of the environment with each child's characteristics (Lerner, 2002).

Much of the research related to predicting reading achievement or reading difficulty has typically (a) included only a one-dimensional reading outcome, such as word identification, (b) examined reading achievement in general, rather than reading underachievement specifically, (c) predicted short-term outcomes that seldom extend beyond the second grade, or (d) considered factors from a single domain (i.e. reading, behavior, or socio-demographic factors) to predict student outcomes (Scarborough, 1998). In identifying possible predictors of LDR, it is important to consider the influence of the students' characteristics and the students' environment exert on the reading process.

There is evidence to support the inclusion of a broader range of factors that may accurately predict the identification of a learning disability. Some research suggests relatively younger students

are more likely to identified with a learning disability (Martin, Foels, Clanton, & Moon, 2004). Empirical research has demonstrated relationships between early social-academic behaviors and overall reading achievement (Duncan et al., 2007), and between student behavior in the classroom and persistent reading difficulties even after intensive intervention (Nelson, Benner, & Gonzalez, 2003). Research on early reading instruction suggests that reading growth is dependent on an interaction between the type of reading instruction students receive and the students' characteristics (Al Otaiba et al., 2008; Felton, 1992; Scanlon & Vellutino, 1996; Xue & Meisels, 2004).

Purpose

The purpose of this study is to understand which factors can be used to aid in the prediction of the students who will be identified with a learning disability and have an Individual Education Program (IEP) with goals in reading (LDR) at two points in elementary school: third grade and fifth grade. Four early elementary school factors that can be readily addressed in school settings were examined: (1) student age at the start of kindergarten, (2) early social-academic behavior, (3) early reading skills, and (4) reading instruction in the sound-symbol relationship.

Hypotheses

In order to examine the role of the four early elementary school factors, an analysis of the Early Childhood Longitudinal Study – Kindergarten Cohort (ECLS-K) data was conducted. The ECLS-K data set allows for the unique opportunity to analyze a nationally representative sample including both child and school-related variables for a single cohort of students from kindergarten through fifth grade.

The hypotheses that were tested in this study are:

H₁: Students who were younger at the start of kindergarten were significantly more likely to be identified as Learning Disabled in Reading at both the third and fifth grades.

H₂: Students who received lower teacher ratings on a measure of social-academic behaviors were significantly more likely to be identified as Learning Disabled in Reading at both the third grade and fifth grades.

H₃: Students who earned lower scores on a measure of early reading skills were significantly more likely to be identified as Learning Disabled in Reading at both the third grade and fifth grades.

H₄: Students who reportedly received less instruction in sound-symbol relationship in reading were significantly more likely to be identified Learning Disabled in Reading at both the third grade and fifth grades.

H₅: The kindergarten factors of (a) age at the start of kindergarten, (b) social-academic behaviors, (c) reading skills, and (d) reading instruction in the sound-symbol relationship were significantly more likely to predict which students would be identified as Learning Disabled in Reading at the third grade compared to the students identified as Learning Disabled in Reading at fifth grade.

Operational Definition of Key Terms

In this research, the following terms are defined with respect to the ECLS-K data set.

Age at the start of kindergarten: Student age in months was calculated from each student's birth date to the first day the school during the 1998-1999 school year. September 1, 1998 was used as the school's start date if the first day of school information was missing.

Early kindergarten: This time period is the first three months of the kindergarten school year (1998-1999) when the ECLS-K study team collected data related to students' early reading skills and social-academic behaviors.

Individual Education Program (IEP): At the time the ECLS-K study was conducted (1998-2005), public schools were regulated by the stipulations of IDEA 1997. The definition of an IEP at

the time of the study specifies that students with disabilities in public, federally funded schools must have an IEP developed, reviewed, and revised in annual meetings. As noted in IDEA, the IEP must include:

- (a) a statement of the child's present levels of educational performance, including (i) how the child's disability affects the child's involvement and progress in the general curriculum...;
- (b) a statement of measurable annual goals, including benchmarks or short-term objectives, related to (i) meeting the child's needs that result from the child's disability to enable the child to be involved in and progress in the general curriculum; and (ii) meeting each of the child's other educational needs that result from the child's disability;
- (c) a statement of the special education and related services and supplementary aids and services to be provided to the child, or on behalf of the child, and a statement of the program modifications or supports for school personnel. (IDEA, 1997, sec. 614(d))

Learning Disability: A student with a school-identified learning disability has an IEP and receives special education services. Each state must adopt criteria for determining whether a child has a specific learning disability consistent with the definition used in the federal Act. The federal Act defines a specific learning disability as:

a disorder in one or more of the basic psychological processes involved in understanding or in using language, spoken or written, which disorder may manifest itself in imperfect ability to listen, think, speak, read, write, spell, or do math calculations. Such term includes conditions such as perceptual disabilities, brain injury, minimal brain dysfunction, dyslexia, and developmental aphasia. Such term does not include a learning problem that is primarily the result of visual, hearing, or motor disabilities, of mental

retardation, of emotional disturbance, or of environmental, cultural, or economic disadvantage. (IDEA, 1997, sec 602(26))

Learning Disability in Reading (LDR): The student received services for a learning disability and had an IEP with a reading goal.

Reading instruction in the sound-symbol relationship: Kindergarten classroom teachers self-reported how frequently the class engaged in reading and language arts activities and specific skills were taught. The original survey was developed by ECLS-K staff and included 42 items. Instruction in the sound-symbol relationship relates to the survey items highly related to letters and phonics.

Reading skills: Student reading performance in early kindergarten was assessed as part of the standardized, norm-referenced direct cognitive measure developed and administered by ECLS-K staff. Reading skills covered in the assessment include: (1) identifying letters of the alphabet, (2) associating letters with beginning sounds, (3) associating letters with ending sounds, (4) recognizing common sight words, and (5) reading words in context.

Social-academic behaviors: Classroom teachers' perceptions of students' social-academic skills were assessed in early kindergarten. Teachers used a four-point Likert-type scale to rate each student on: (1) attentiveness, (2) task persistence, (3) eagerness to learn, (4) learning independence, (5) flexibility, and (6) organization.

Overview of the Dissertation

The literature review in Chapter 2 is divided into four sections. The literature related to prediction of reading achievement in general, and reading difficulties and learning disabilities specifically, is reviewed in terms of factors related to age at the start of kindergarten, early social-academic factors, early reading skills, and kindergarten reading instruction in the sound-symbol relationship. Relevant studies based on the ECLS-K data are included.

Chapter 3, Methodology, describes the ECLS-K data set, including how participants were identified, the variables and assessments, and the study procedures from the six-year longitudinal study. The specific independent and dependent variables are identified and discussed. Details regarding the analysis used to investigate the hypotheses are provided.

Chapter 4, Results, presents the outcomes of the analysis outlined in Chapter 3. The results of the logistic regressions to predict identification of LDR at third and fifth grades are presented separately and then compared. Tables are used to display results.

The final chapter, Discussion, explores the implications of the results as related to early identification of students with learning disabilities. The limitations of the present study and suggestions for future research are discussed.

CHAPTER 2 – LITERATURE REVIEW

Considerable research has investigated early childhood predictors of reading achievement, reading difficulty, and learning disability in reading. The majority of these studies focused on students in early elementary school and short-term student outcomes (see Scarborough, 1998 for a review). Longitudinal studies predicting later academic achievement, and specifically reading deficits, have been beset with the problem of correctly identifying the students who will later have the most reading difficulty (Scarborough; Snow et al., 1998; Torgesen, 1999). Several studies' analyses yield high false positive rates (classifying students as at-risk when they do not need to be) and false negative rates (classifying students as not at-risk when they should be). In their reviews of the literature on reading difficulty, Scarborough and Snow et al. noted that often the individual factors that predict later reading difficulty and reading achievement were not studied in combination. They suggested examining variables that individually predict later reading difficulty in the same study.

The literature relevant to this study includes research on reading achievement, reading difficulty, and learning disability. Examining consistent predictors of reading achievement allows for hypotheses about the possible relationship between these factors and reading difficulty. Considering both reading difficulty and learning disability literature is necessary because several overlapping terms are used to describe the population of students with reading difficulties, including reading disability, dyslexia, learning disability, and at-risk students. There are differing perspectives in the fields of special education and reading education about the definition of LD and the differences between students identified as having a learning disability in reading and those with general underachievement in reading (Fuchs, Fuchs, Mathes, Lipsey, & Roberts, 2001; Kavale & Forness, 2000; Lyon, 1989; MacMillan & Siperstein, 2001; Stanovich, 1988). Recently, learning disability has

been defined as a limited response to intervention (Fuchs, & Fuchs, 2006). As a result, examining a wide array of populations will help identify potential predictors of LDR.

This literature review will discuss the factors that are related to reading achievement, reading difficulty, and learning disability. Longitudinal studies provide insight into the relationship among early childhood predictors and short- or long-term outcomes. Cross-sectional studies describing the characteristics of students with LD or reading difficulty provide other factors that might be useful indicators of LDR. The review is divided into four sections: age at the start of kindergarten, social-academic behaviors, early reading skills, and early reading instruction. Relevant studies using the ECLS-K data are included.

Age at the Start of Kindergarten

The age of students entering kindergarten varies considerably. In addition to the expected variability in age, some students may have started kindergarten before the standard guidelines, been retained, or been “red-shirted” (intentionally delayed kindergarten entry) (Graue & DiPerna, 2000). Chronological age is an important consideration because it may be an indicator of student maturity and readiness to learn. Readiness can be conceptualized in several different ways. Popular definitions of readiness include a change in maturation that occurs over time or a group of skills that can be taught (Hair, Halle, Terry-Humen, Lavelle, & Calkins, 2006). Readiness is more appropriately described as an interaction between the child and his/her environment (Meisels, 1998) and includes social/emotional, language, and cognitive development (Hair et al.).

Kindergarten was once considered a time for teaching students to learn in school, but increasingly students are expected to begin school with the skills necessary to benefit from a formal academic curriculum (Graue, 1993). Younger students may be at risk for having lower levels of school readiness since they have had less time to learn the academic and behavioral skills necessary for school. This may place younger students at a distinct disadvantage if they demonstrate fewer

academic skills and have more difficulty working independently in the classroom, especially compared to their same grade but older peers. Classroom teachers often initiate special education referrals (Gerber & Semmel, 1984). If teachers perceive younger students as having more academic and behavioral difficulties compared to others in their grade, younger students may be more likely to be referred for or identified as having a learning disability.

The age requirement for beginning kindergarten varies considerably by state (see Table 1). Cut-off dates range from the first of July to the first of January (Education Commission of the States, 2005). September first is the most frequent cut-off date for kindergarten. Six states do not provide specific guidelines. Regardless of the particular cut-off date, there will always be relatively older and relatively younger students (Shepard & Smith, 1986).

The pertinent literature related to student age at the time of school entry and reading achievement will be reviewed first. Learning disability identification and age at time of school entry will then be discussed. The studies in this review measure student age at the time of school entry in months. A few studies analyzed age in single month increments or as a continuous variable, but the majority of studies grouped two to four months together when examining the relationship between age at time of school entry and reading achievement or learning disability identification. For example, students born in January through March were compared to students born in April through June, July through September, and October through December. The youngest students were those who were born in the three-month time period immediately preceding the kindergarten cut-off date. In a state with the first of October as the birth date guideline, the youngest students would have birthdays in July through September. Studies vary greatly in how student age at time of kindergarten is organized.

Table 1

Age Regulations for Beginning Kindergarten for Each State and the District of Columbia (DC)

State	5 on or before	State	5 on or before
Alabama	September 1	Montana	September 10
Alaska	August 15	Nebraska	October 15
Arizona	September 1	Nevada	September 30
Arkansas	September 15	New Hampshire	LEA determines
California	December 2	New Jersey	LEA determines
Colorado	LEA determines	New Mexico	September 1
Connecticut	January 1	New York	LEA determines
Delaware	August 31	North Carolina	October 16
DC	December 31	North Dakota	September 1
Florida	September 1	Ohio	September 30 or August 1
Georgia	September 1	Oklahoma	September 1
Hawaii	December 31	Oregon	September 1
Idaho	September 1	Pennsylvania	LEA determines
Illinois	September 1	Rhode Island	September 1
Indiana	July 1	South Carolina	September 1
Iowa	September 15	South Dakota	September 1
Kansas	August 31	Tennessee	September 30
Kentucky	October 1	Texas	September 1
Louisiana	September 30	Utah	September 2
Maine	October 15	Vermont	January 1 or LEA determines
Maryland	October 31	Virginia	September 30

Table 1 continued

State	5 on or before	State	5 on or before
Massachusetts	LEA determines	Washington	August 31
Michigan	December 1	West Virginia	September 1
Minnesota	September 1	Wisconsin	September 1
Mississippi	September 1	Wyoming	September 15
Missouri	August 1*		

Notes. *LEA of a large metropolitan district can choose between August 1 and October 1
 LEA – Local Education Agency
 From “Access to kindergarten: Age issues in state statutes,” by the Education Commission of the States, 2005, Retrieved July 31, 2008, from <http://www.ecs.org/clearinghouse/58/27/5827.doc>
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Reading Achievement

This section will discuss the conclusions of two literature reviews that summarized findings of studies published through the late 1980s and 1990s. Three recent longitudinal studies that investigated the relationship between age at the time of school entry and achievement are specifically reviewed. The findings of one study and two doctoral dissertations that used the ECLS-K data set will also be considered.

Shepard and Smith (1986) summarized the literature through the mid-1980s on age and achievement. They concluded that for overall achievement, the differences between younger and older students in each grade may be statistically significant, but these numerical differences do not translate into a practical significance in the classroom and in students’ lives. They did note that one study found that younger students with lower levels of reading ability may be at the greatest disadvantage, but there is limited evidence to support the interaction between age and reading skills leading to lower levels of reading achievement. In general, Shepard and Smith concluded that any

differences between younger and older students in the same grade were not maintained past third grade.

Scarborough's (1998) review of the literature over a decade later summarized the results of longitudinal studies that examined the relationship between chronological age and reading achievement. Based on this review, Scarborough concluded there was sufficient evidence that the youngest students in a classroom had lower levels of reading achievement; however, age was "not an important risk factor" (p. 78).

One longitudinal study from Scarborough's (1998) review will be highlighted here. Morrison, Griffith, and Alberts (1997) examined the reading achievement differences among three groups of students at specific time points and reading growth over time. In their analysis, the researchers controlled for the students' IQ, parental and maternal occupational status and education, and history of day-care attendance. Group membership was determined by student birth date and grade placement. Students with birth dates within two months of the district cut-off date (March 1st) were considered "young first graders." Students who missed the cut-off date by two months were "old kindergartners" and those who were a year older than the "old kindergartners" were classified as "old first graders." The analysis of the initial reading assessment indicated small but significant differences among the three groups of students. Older first graders had the highest reading scores and the oldest kindergartners had the lowest reading scores. At the end of the school year, the first grade students made similar progress in reading. Initial differences in achievement persisted. The young first graders scored significantly higher on reading measures than the old kindergarten students, demonstrating that they benefited from the first grade instruction. The authors concluded that instruction, not age, influenced student academic growth in reading.

The National Institute of Child Health and Human Development (NICHD), Early Child Care Research Network (2007) examined age as a continuous variable as it related to achievement and

social emotional functioning. The birth through third grade longitudinal study included over 900 children and investigated a variety of educational and developmental questions. The study used standardized measures of student achievement and teacher ratings of perceived student achievement. No significant relationship was found between age at time of kindergarten entry and social competence, internalizing behavior problems, or externalizing behavior problems. Over time, older students made more progress on academic measures; however, effect sizes were small. Other child factors such as home environment and childcare history had a greater relationship with school achievement than age at time of kindergarten entry. However, in contrast to the findings of the scores of the standardized reading assessment (letter and word identification), kindergarten teachers rated younger students lower in reading skills than older students.

Martin et al.'s (2004) study examined several student outcomes as they related to age at time of school entry. The portion of the article that pertains to the relationship between student age and learning disability identification will be discussed in a later section. The researchers analyzed the performance students on a group-administered standardized test. The year was divided into four sections with students born in June-August the youngest in the grade. Younger students scored significantly lower than other groups of students on the reading measure. When students who had been retained were excluded from the analysis, the reported effect size was small ($d = .13$). The effect sizes increased ($d = .26$) when retained students were included in the analysis.

McCoach, O'Connell, Reis, and Levitt (2006) used the ECLS-K data with growth curve modeling to examine student's reading growth in kindergarten and first grade as it related to student characteristics and school characteristics. Their analyses found few differences between older and younger students' reading achievement. Older students had slightly higher reading scores and made slightly more growth in reading during the summer between kindergarten and first grade. However,

student SES had a larger impact on students' initial reading scores and reading growth over the summer.

Two studies (doctoral dissertations) also used the data from the ECLS-K to examine the relationship between student age at time of school entry and reading and math achievement (Fleischman, 2007; Yesil-Dagli, 2006). Although both examined age in kindergarten with the same data set, the studies reached different conclusions. The two studies differed in terms of data analysis, data collection wave, method used to group students by birth date, and types of reading scores.

Using Hierarchical Linear Modeling (HLM), Yesil-Dagli (2006) compared the reading achievement of five groups of students from kindergarten through third grade. Students were grouped into categories based on their age in months as of September 1, 1998. Students were classified as early entrant kindergarteners (59 months or younger), younger-ontime entrants (60-63 months), medial-ontime entrants (64 to 67 months), older-ontime entrants (68-71 months), and delayed entrants (72 months or older). The author concluded that, in general, age at time of kindergarten entry was a significant factor in reading achievement in kindergarten and first grade, but not in third grade. Younger-ontime entrants had lower Item Response Theory (IRT) reading scores than medial-ontime entrants, who in turn had lower IRT reading scores than older-ontime entrants. Students who had delayed kindergarten entry had higher reading scores than medial-ontime students in each school year. Although there were early significant differences between groups, the majority of these differences in reading were not sustained by third grade. The author concluded that age at time of kindergarten entry was not a relevant indicator of later reading achievement.

Using a repeated-measures MANCOVA analysis of the kindergarten through fifth grade ECLS-K data, Fleischman (2007) concluded that there were significant differences between students who were born in the summer months (June, July and August) and those born during the other months of the year. Although younger students made gains in reading, the difference between summer-born

students and other students remained significant through fifth grade. In fifth grade, when controlling for differences in race/ethnicity, SES, gender, pre-kindergarten participation, Head Start, and disability status, summer-born students scored significantly lower on a measure of reading achievement (estimated marginal mean t -score=49.30) compared to students born during the other months of the year (estimated marginal mean t -score = 51.03). The educational relevance of the significant difference was not discussed.

Research has yielded statistical differences in achievement between younger and older students in the same grade; however, the educational and practical relevance of this difference in terms of reading achievement is in doubt (Morrison et al., 1997; Scarborough, 1998; Shepard & Smith, 1986). Younger and older students appear to make similar progress in reading over time and any initial differences generally dissipate by mid-elementary school (Shepard & Smith; Yesil-Dagli, 2006). There is some evidence that teachers perceive younger students as having fewer reading skills than older students and than formal reading measures indicate (NICHD, 2007). However, there is not sufficient evidence to make definitive conclusions about the differences between standardized achievement tests and teacher ratings.

Learning Disability Identification

Student age at the time of school entry and students born in the summer months, in particular, appear to be related to identification of a learning disability. Four studies that examined the relationship between age at the time of school entry and identification of a learning disability will be reviewed here. Researchers in three studies examined LD identification rates to determine if younger students were more likely to be identified LD than would be expected due to chance. Two of the studies surveyed students from a single state and one study examined a sample of students from one metropolitan area. In the fourth study, student records were analyzed to compare referral for psychological testing and LD identification rates.

Shortly after the passage of P.L. 94-142, Maddux (1980) compared the expected proportion of LD identification based on Census records to the actual proportion of LD identification in a midwestern city. Students born in May through August were more likely than would have been expected due to chance to be identified LD. Younger students in first through fourth grades and fifth through eighth grades were identified with LD at a higher rate. There were no differences in the high school sample between groups of students born at different times of the year.

Diamond (1983) examined age at time of school entry in single month units as related to LD identification. In this analysis of more than 74,000 students ages five to twenty, students born in December were the youngest in their respective grade. The month of birth was significantly correlated with identification of LD. Specifically, younger students who were born in December were one and a half times more likely to be identified as LD compared to those born in January.

In an analysis of the referrals to school psychologists for educational assessments at seven schools during one academic year, younger students in each grade were more likely to be referred by teachers for academic difficulties than older students (Tarnowski, Anderson, Drabman, & Kelly, 1990). The records of kindergarten through eighth grade students with IQs greater than 80 who were referred for academic difficulty were examined to determine the relationship between student chronological age and referral rates. Months were grouped into four sections, and students who were born in July through September were the youngest in each grade. An analysis of the available data found that students born in January through March had higher IQs than the younger students. However, there were no significant group differences in reading, math or written language skills. After adjusting for varying birth rates during the year, younger students in each grade were more likely to be referred for psychological testing than students born in other three-month periods. Although younger students were more likely to be evaluated for a possible learning disability, they were not more likely to be identified with a learning disability.

More recently, Martin et al. (2004) examined the school records of 6,292 fifth through ninth grade students identified with LD from 28 school districts in one state. Only students of European decent were included in the analyses. Four groups of students were compared: those born in September through November, December through February, March through May, and June through August. Students born in June through August (summer months) were the youngest students in the grade. The younger students were 12.5% more likely to be identified LD than would be expected due to chance. Students born March through May were slightly more likely than would be expected to be identified LD and older students were less likely to be identified LD than would be expected. Younger students had lower scores in reading and vocabulary on a group-administered standardized test. The initial analysis did not include students who were retained. For students who were retained, almost twice as many were the youngest in their grade (born in June through August).

Younger elementary and middle school students in their respective grades were more likely to be identified with a learning disability, especially if the younger student had also been retained (Diamond, 1983; Maddox, 1980; Martin et al., 2004). These three studies compared the prevalence to what would be expected due to chance to the observed prevalence rates of students with LD and concluded that younger students were over-identified LD. These results differ from the results of the study by Tarnowski et al. (1990) who compared the prevalence of LD in groups of students organized by birth month and concluded that there was not a difference in LD identification rates.

Summary

The research evidence suggests that age in kindergarten does not have a meaningful impact on reading achievement. However, there is conflicting evidence related to age and learning disability identification. On standardized tests, students who were relatively younger compared to relatively older students in their grade made similar progress in reading (Morrison et al., 1997). In general, initial reading achievement levels of younger and older students were statistically different but not

considered educationally relevant (McCoach et al., 2006; NICHD, 2007; Scarborough, 1998; Shepard & Smith, 1986). Many early differences disappeared in late elementary school. Some research shows that teachers perceived younger students as less proficient in reading as their older classmates (NICHD) and referred younger students for special education evaluations were made more frequently (Tarnowski et al., 1990). When comparing the rate of LD identification to what would be expected if LD identification was randomly distributed across student age, younger students were more likely to be identified LD than would be expected (Diamond, 1983; Maddux, 1980; Martin et al., 2004). However, higher identification rates were not found when analyzes investigated high school samples (Maddox). When comparing groups of students to each other on the rate of LD identification, there were no differences in group identification rates (Tarnowski et al.). Age at time of kindergarten entry has a small, but not educationally relevant relationship with academic achievement overall, but there is evidence suggesting that age at time of school entry is related to identification of a learning disability.

Social-academic Behaviors

Certain behaviors are necessary in order to benefit from classroom instruction and are related to reading achievement and LDR. Teachers rated behaviors such as completing assignments in a timely manner, making eye contact, following directions, requesting assistance, and using time wisely as important for students to consistently display (Gresham & Elliot, 1988). A survey of kindergarten teachers by the National Center for Education Statistics (NCES) (Heaviside, Farris, & Carpenter, 1993) found that at the beginning of kindergarten teachers were more concerned about student behavior (communicating verbally, being enthusiastic about learning, following directions and not being disruptive) than student academic skills (problem solving skills, knowledge of shapes and colors). Student social-academic behaviors are relevant to the classroom and are related to reading achievement and reading difficulty.

There are various terms and constructs used to describe student behavior and social skills. Social-academic behaviors refer to the skills and conduct necessary for the completion of academic tasks, such as attention, task persistence, working independently, and organization. The relationship between classroom behavior and overall reading achievement will be considered, followed by a discussion of the emerging understanding of the role of student behavior in the efficacy of reading interventions. The literature related to elementary school students with learning disabilities and social-academic behavior will also be reviewed.

Reading Achievement

In a meta-analysis of longitudinal studies published between 1985 and 1998 examining preschool and kindergarten predictors of later achievement and behavior, La Paro and Pinanta (2000) stated that there were notably few longitudinal studies investigating early behavior as a predictor of achievement. Since the publication of the meta-analysis, several longitudinal studies have examined the relationship between early school behavior and academic achievement. Although academic-related behaviors do not have as strong a relationship with reading achievement as early reading skills, a consistent association has been found between student classroom behavior and reading achievement. Five longitudinal studies will be discussed, including two studies that utilized data from the ECLS-K.

McClelland, Acock, and Morrison (2006) conducted a kindergarten through sixth grade longitudinal study examining the relationship between early elementary behavior and later achievement. Students with lower ratings of self-regulation, responsibility, independence, and cooperation made less reading growth from kindergarten through second grade than students with higher teacher ratings. In the third through sixth grades, students who initially had lower teacher ratings of behavior scored significantly lower on high-stakes reading tests. Student growth rates were

similar; the reading achievement gap did not widen between the students with initially higher and lower behavior ratings.

An early elementary school longitudinal study by Chard et al. (2008) examined the students' (including students with disabilities) behavior and achievement from first grade through third grade. The researchers assessed students' word identification, decoding, oral reading fluency, reading vocabulary and reading comprehension skills. Teachers rated student behavior using the Social Skills Rating Scale (SSRS). The SSRS has three rating scales assessing students' positive social skills, inappropriate behaviors, and general academic performance (Gresham & Elliot, 1990). Teacher ratings of students' academic competence significantly predicted third grade oral reading fluency (Chard et al.). However, this scale provides little information on students' classroom behaviors because it is a measure of academic skills, such as how a student's reading skills compares to other students (Gresham & Elliott). First grade students' social skills, including cooperation, responsibility, and self-control, were significantly correlated with third grade measures of reading skills (.19 with vocabulary and .36 with reading comprehension). Problem behaviors were significantly and negatively correlated with reading outcomes (-.17 and -.30), indicating that students who displayed inappropriate behavior in the classroom had lower levels of reading achievement. Students' home language and first grade special education status were not related to later reading skills.

Two studies (Duncan et al., 2007; Mills, 2007) used data from the ECLS-K to examine the relationship between student classroom behavior and achievement. The ECLS-K includes five subscales of student behavior and social skills adapted from the SSRS: Approaches to Learning, Self-Control, Interpersonal Skills, Externalizing Problem Behaviors, and Internalizing Problem Behaviors (Institute of Education Sciences [IES], 2008). The Approaches to Learning subscale, which includes the social-academic behaviors, assesses student "attentiveness, task persistence, eagerness to learn, learning independence, flexibility, and organization" (USDE NCES, 2000, p. 2-16).

Duncan et al.'s (2007) analysis of six longitudinal data sets examined kindergarten cognitive, attention, and socioemotional skills and later reading achievement. The researchers analyzed each study individually and then summarized the findings of the six studies in a meta-analysis. They concluded that measures of students' math skills, reading skills, and attention in the early school years were the best predictors of later achievement. In the meta-analysis, internalizing behavior, externalizing behavior, and interpersonal social skills were not strongly associated with later academic outcomes. Results of the regression analysis with the kindergarten through third grade ECLS-K data set indicated that kindergarten teacher ratings on the Approaches to Learning subscale had small, but significant correlations with standardized reading achievement scores and teacher ratings of student reading ability ($r = .32$ and $r = .35$ respectively). Measures of interpersonal skills, externalizing problem behavior, internalizing problem behavior, and self-control had correlations of .22 or less with third grade reading measures.

Another study used the kindergarten through fifth grade data from the ECLS-K to examine the relationship between behavior and reading achievement for students with learning difficulties (Mills, 2007). Students who were reading at or below the 30th percentile on the standardized reading measure or were rated by their teacher as below average in reading were identified as having reading difficulties. Students with reading difficulties in third and/or fifth grades had significantly lower teacher ratings on the Approaches to Learning subscale than students who did not experience difficulty learning in school. Students with both math and reading difficulties were rated as having fewer appropriate social-academic behaviors than students with only reading difficulties.

The studies discussed above used teacher ratings of student behavior, rather than a direct measure of student classroom behavior. Although teacher ratings might be criticized for (a) introducing teacher bias, (b) including limited information related to the context of behavior, or (c) providing little specific details on the behavior intensity, teacher ratings provide a quick and

unobtrusive measure of student classroom behavior (McKinney, McClure, & Feagans, 1982).

Furthermore, studies using direct measures of student behavior have been consistent with the results of studies using teacher ratings of behavior. McClelland et al. (2007) used a direct measure of student behavioral regulation to assess preschool students' attention, memory, and inhibition. Preschool students who were initially better able to regulate their behavior and who continued to show improvement in behavior regulation also made significant gains in reading.

The results of these longitudinal studies consistently demonstrate a significant relationship between social academic behaviors and later reading achievement (Chard et al., 2008; Duncan et al., 2007; McClelland et al., 2006; Mills, 2007). Teacher ratings of student behavior and direct measures of student behavior explain a significant amount of the variance in reading achievement measures through elementary school.

Reading Interventions

A number of studies have investigated the role of student behavior or attention as it relates to the effectiveness of reading interventions. The effectiveness of a reading intervention may be impeded if a student has difficulty sustaining appropriate behavior during instruction. Behavior demonstrated in a small group or individual intervention session may be indicative of the student behavior in the larger general education classroom (Torgesen et al., 1999). Two recent summary studies will be used to frame the discussion of social-academic behavior and reading intervention. As part of a larger literature review, Al Otaiba and Fuchs (2002) reviewed seven intervention studies that discussed student behavior or attention. Nelson et al. (2003) later conducted a meta-analysis on the student characteristics related to early reading intervention effectiveness. The behavior portion of the Nelson et al. analysis included one study reviewed by Al Otaiba and Fuchs and five additional studies that used teacher ratings of student behavior. After summarizing the literature review and meta-analysis, the individual studies included in the articles by Al Otaiba and Fuchs and Nelson et al. will

be briefly discussed. The individual studies varied considerably in the student samples and in the conceptualization and definition of behavior.

In their review of the intervention research, Al Otaiba and Fuchs (2002) located seven studies that included a statement about or an investigation of attention or behavior in students nine years old and younger who were not responsive to reading interventions. Students exhibiting behavioral difficulties often made less progress in reading interventions. Al Otaiba and Fuchs noted that there was variation in the individual studies' (a) definitions of unresponsiveness, (b) labels and characteristics of study participants, (c) methods of interventions, and (d) information on treatment fidelity.

Nelson et al. (2003) investigated intervention studies and characteristics of students who demonstrate resistance to reading interventions. The results of the meta-analysis indicate that rapid naming, phonological awareness, problem behavior, alphabetic principle, memory and IQ were more predictive of treatment effectiveness than disability identification, history of retention, ethnicity, or grade level. The total effect size for problem behavior (weighted mean $Z_r = .46$) was similar to the effect size for rapid naming (weighted mean $Z_r = .51$) and phonological awareness (weighted mean $Z_r = .42$). The studies included in the meta-analysis used teacher ratings of student behavior. The meta-analysis results suggest that classroom behavior is related to reading intervention effectiveness.

Six studies in the Al Otaiba and Fuchs (2002) review indicated a possible relationship between attention and reading interventions. Two studies each included a student with possible attention deficits who failed to make adequate progress on the reading interventions (Snider, 1997; Uhry and Shepherd, 1997). Six students demonstrated little improvement after receiving one-on-one tutoring in reading and spelling (Vadasy, Jenkins, Antil, Wayne, and O'Connor, 1997). These students were observed to be distractible during the tutoring sessions and were rated by their teachers as not working as hard, demonstrating less appropriate behavior, and learning less than other students;

however, the differences were not statistically significant. A non-standardized, researcher-made behavior rating was used in this study.

Three studies that were classified as providing support for students resistant to instructional intervention due to attention problems (Al Otaiba & Fuchs, 2002) were not included in the Nelson et al. (2003) meta-analysis for behavior. Nelson et al. did use data from the three studies in analyses of other areas of analysis (i.e. phonemic awareness). O'Shaughnessy and Swanson (2000) used the SSRS in their 6-week intervention study with 45 students. There were no intervention group differences on the three subscales of the SSRS, but limited information on students' SSRS scores is provided in the article. The Academic Competence subscale was a significant predictor the correct number of words read per minute on a measure of fluency. The Academic Competence subscale assesses limited information about a student's behavior and is more of a measure of academic skills (Gresham & Elliot, 1990). Two published articles from one longitudinal study reported few significant results to support a relationship between student performance on executive functioning tasks and reading intervention effectiveness (Vellutino et al., 1996; Vellutino, Scanlon, & Lyon, 2000). Nelson et al. (2003) noted that these studies were excluded in their meta-analysis since the studies included a measure of executive functioning rather than observed classroom behavior.

An investigation by Torgesen et al. (1999) was the only study included in both the review by Al Otaiba and Fuchs (2002) and the meta-analysis by Nelson et al. (2003). Al Otaiba and Fuchs noted that several students demonstrated attention difficulties during the one-on-one tutoring sessions. Nelson et al.'s analysis yielded an average correlation of .52 between the behavior measures and student reading outcomes. Eligibility in the Torgesen et al. study was determined by low kindergarten phonological processing skills. Participants were placed in one of two decoding interventions, a general classroom instruction group or a control group. Teacher ratings of kindergarten students' social-academic behaviors were one of several significant predictors of students' word reading skills

growth from kindergarten through second grade. Other significant predictors included kindergarten measures of phonemic awareness, short-term memory, cognitive ability, RAN and parents' education and occupation.

Foorman, Francis, Fletcher, Mehta, and Schachneider (1998) conducted an intervention study with 285 first and second graders attending schools that received Title I assistance. Students participated in one of four types of general classroom reading instructional programs during the school year: direct code instruction, embedded code instruction, research-based implicit code instruction, or the district standard implicit code instruction. Teacher ratings of student behavior and attention had smaller average correlations with student reading outcomes (.29) than the Torgesen et al. (1999) study (Nelson et al., 2003), even though both studies used the same behavior measure.

In a kindergarten through first grade study, Al Otaiba (2001) examined the differences among 79 students participating in kindergarten and first grade reading interventions and 25 control students. Students were classified as not responding, sometimes responding, or responding to the intervention based on the students' scores relative to the mean score on various fluency measures. Classroom teachers rated nonresponders as having significantly more difficulty with attention and conduct in the classroom than the responsive students. There was no significant difference in the first grade fluency scores of the sometimes responders and nonresponders. Nelson et al. (2003) reported an average correlation for problem behavior in this study of .51. Other significant group differences were found on measures of grammatical closure, vocabulary, sentence imitation, rapid letter naming, rapid letter sound production, and segmentation. In a follow-up study two years later (published after the Nelson et al. meta-analysis and when the majority of the students were in third grade), approximately half of the original cohort was located (Al Otaiba & Fuchs, 2006). Differences persisted between the groups, with nonresponders continuing to have the most difficulties. The majority of the nonresponsive

students experienced reading problems through third grade, including retention for reading difficulty and receiving special education services.

Three intervention studies by Lane and colleagues (Lane, 1999; Lane, O'Shaughnessy, Lambros, Gresham, & Beebe-Frankenberger, 2001; Lane et al., 2002) included first grade students experiencing reading difficulties and substantial behavioral difficulties. Classroom teachers rated student behavior using the SSRS and other behavioral measures throughout the interventions. Nelson et al. (2003) found average correlations ranging from .40 to .66 between teacher ratings of student social skills and problem behavior and scores on reading measures used to assess the effectiveness of the interventions. These results suggest an interaction between student behavior and positive outcomes of intensive behavioral and reading interventions. It is important to note that the samples in these studies included students with both reading and significant behavior problems in the classroom. The behavior difficulties experienced by the students in these studies may not be representative of the characteristics of students who are later identified with a learning disability. Compared to students with emotional and/or behavioral disorders (EBD), students with LD demonstrate fewer behavioral problems, but students with LD and EBD may have some similar patterns of social interactions (Sabornie, Cullinan, Osborne, & Brock, 2005; Sabornie, Evans, & Cullinan, 2006). Not knowing the disability identification outcomes of the students in the studies by Lane and colleagues limits the comparison of their results to a study including only students with LD.

Several studies summarized by Al Otaiba and Fuchs (2002) and Nelson et al. (2003) included different student populations and used different definitions of behavior. Many of the studies only included vague and unquantifiable informal observations (Snider, 1997; Uhry & Shepard, 1997; Vadasy et al., 1997) or measures of executive functioning rather than observed classroom behavior (Vellutino et al., 2000; Vellutino et al., 1996). Few studies examined student outcomes beyond the first or second grade. However, the recent studies indicate that students who were judged by their

teachers as demonstrating behavioral difficulties or inattention may not respond as positively to intensive reading interventions (Al Otaiba, 2001; Al Otaiba & Fuchs, 2006; Torgesen, 1999).

Learning Disability Identification

This section will examine the social-academic behaviors of elementary school students who have already been identified as having a learning disability. Relevant behavior constructs included in the review address attention, task persistence, motivation, independence, and learned helplessness. Two longitudinal studies, two meta-analyses, a literature review, and several cross-sectional studies addressing the social-academic behavior of students with learning disabilities are discussed.

There is evidence to suggest that students with LD demonstrate considerably less task persistence or attention to task than students without LD. Bender and Smith (1990) conducted a meta-analysis of 25 studies on students with LD published from 1969 to 1987 that investigated on-task behavior, conduct problems, distractibility, and withdrawn behavior. The analysis included studies that used teacher ratings of student behavior and/or direct observations of student behavior in the classroom. Students recently identified as LD were more likely than students without disabilities to be distractible, have conduct problems, or appear withdrawn and less likely to be on-task. Teacher ratings of student off-task behavior tended to be higher than the direct observations of student behavior. The authors concluded that teacher ratings of student behavior should be included in the LD identification process since “behavioral problems represent a major impairment among students with LD” (Bender & Smith, p. 304).

A series of studies reporting results from a longitudinal study by McKinney and colleagues followed matched pairs of students with LD and without LD. Students were initially identified as LD in early elementary school at age six or seven. McKinney and Feagans (1983) found that students with learning disabilities were less task-oriented and more distractible than students without disabilities. In second and fourth grades, students with LD were rated as less task orientated, more

introverted, less creative and less curious than the matched pairs without disabilities (McKinney et al., 1982). Not all of the students with LD demonstrated difficulty with attention, withdrawal, or behavior problems. However, those students rated as having more attention and problem behaviors scored lower on measures of reading, decoding, and reading comprehension (McKinney & Speece, 1986). Direct classroom observations revealed that students with LD were more likely to interact with the teacher and less likely to initiate self-directed learning. This pattern indicates that students with LD were less likely to work independently in the elementary school classroom. The results of a follow-up study indicated that students who initially demonstrated difficulty with attention and conduct had lower levels of academic achievement at age eleven than students who did not demonstrate classroom behavior difficulty or students who were withdrawn (McKinney & Speece). The students who no longer received special education services had significantly more favorable teacher ratings of academic competence during the first year of the study than the students who remained in special education (Osborne, Schulte, & McKinney, 1991). The results from these longitudinal studies suggest that students identified with LD demonstrated more behaviors that interfered with learning. The students with early social-academic behavioral deficits were more likely to experience long-term reading difficulties and to continue special education program participation.

Burns and Dean (2005) specifically examined one potential underlying reason for the off-task behavior of students with LD. Five elementary school students identified with a learning disability and specific reading deficits also had difficulty sustaining attention and staying on-task. The students were assessed to determine the number of novel (Esperanto International Language) words they could learn at one time. Word learning and on-task behavior were recorded during daily learning trials. Once the students were no longer able to recall any additional words in the trial, the number of off-task behaviors markedly increased as students were presented with new words to learn. In terms of classroom applications, the results of this study indicate that students with learning disabilities engage

in more off-task behaviors when classroom instruction exceeds their abilities to acquire additional information.

There has been considerable debate whether the learning problems experienced by students with a history of learning difficulty preceded or were a result of motivational difficulties and learned helplessness (Licht, 1983). Measures of motivation provided a better than chance classification of students experiencing academic difficulties (Siderdis, Morgan, Botsas, Padelia, & Fuchs, 2006). In one study, Siderdis et al. used receiver operating characteristic curves and linear discriminant function analysis to determine the accuracy of a reading motivation measure to classify first grade students at-risk for reading disabilities. Measures of intrinsic motivation and reading self-concept effectively classified young students with reading difficulty.

In their analysis of motivation and attribution comparing students with LD and without LD, Pintrich, Anderman, and Klobucar (1994) noted that although there were differences in the two groups on measures of motivation, these differences appeared to vary more between individual participants rather than a clear pattern of motivation differences between the two groups. In their summary of 15 studies examining the relationship between reading and student motivation, Morgan and Fuchs (2007) concluded that the research supports a bi-directional relationship between reading and motivation. The previous research provided evidence for both reading skills predicting motivation levels and reading skills predicting levels of motivation.

Differences in social-academic behaviors may depend on the definition used to identify students with reading difficulty. Few differences in social-academic behavior were found in a comparison of students who meet a discrepancy criterion for LD to students with low achievement who did not meet a discrepancy criterion for LD. The Connecticut Longitudinal Study followed 445 students from kindergarten through eleventh grade (Shaywitz, Fletcher, and Shaywitz, 1996). A comparison of a subsample from the study (32 students with ability-achievement discrepancy in

reading and 38 students who were below average in reading but did not have a discrepancy) found no significant differences in kindergarten scores on measures of motor skills, language, perception, and memory. Classroom behavior as rated by teachers did not distinguish between the groups or predict which students had discrepancies between their IQ and achievement and those who do not; the two groups were very similar over time. Shaywitz et al. did *not* compare students receiving special education services and those who did not receive services. The two comparison groups in the subsample did not differ on levels of special education services received for reading. Early student behavior, as determined by this small subgroup of students in a single state, may not adequately predict achievement-ability discrepancies often used to identify students with LD. However, social-academic behaviors may predict which students are more likely to receive special education services for LD.

Students with learning disabilities often demonstrate distinctively different classroom social-academic behaviors than students without learning disabilities. Students with LD demonstrate deficits in on-task behavior and attention (Bender & Smith, 1990; Burns & Dean, 2005; McKinney & Speece, 1986) and motivation (Siderdis et al., 2006). Evidence of a reciprocal relationship between motivation and reading difficulty (Morgan & Fuchs, 2007) and considerable individual variability in motivation (Pintrich et al., 1994) indicates a complex relationship between motivation and LD identification. School identification of LD may be more indicative of social-academic difficulties than the presence or absence of a numerical difference on measures of ability and achievement (Shaywitz et al., 1996).

Summary

Social-academic behaviors, as rated by teachers, such as attending, persisting with tasks, completing assignments and following directions consistently have a small, yet significant relationship with reading achievement (Duncan et al., 2007; McClelland et al., 2006). These social-academic behaviors differentiate between students without academic difficulties and students who are

resistant to early reading interventions or identified LD (Al Otaiba & Fuchs, 2006; Nelson et al., 2003; Torgesen et al., 1999). These early social-academic behavior deficits may also be characteristic of other disabilities (Sabornie et al., 2006), vary on an individual basis (Pintrich et al., 1994), or be demonstrated by students without school identified learning disabilities (Shaywitz et al., 1996). However, deficits in early classroom behaviors are indicators of LD and learning difficulties (McKinney et al., 1982; McKinney & Speece, 1986; Nelson et al., 2003; Siderdis et al., 2006).

Reading Skills

This section will focus on the reading and reading-related skills indicative of reading achievement and reading difficulty. In general, early reading skills predict later reading skills. However, early reading skills do not account for all of the variability in later reading achievement, and do not adequately identify the students who will experience the most reading difficulty (Scarborough, 1998; Snow et al., 1998). Letter identification is consistently the strongest single predictor of later reading achievement (Scanlon & Vellutino, 1996; Scarborough). Other reading related skills such as phonemic awareness, rapid automatic naming (RAN), concepts of print (COP), memory, and spelling have been investigated as predictors of later reading ability and reading difficulty. The use of the similar terms phonological awareness and phonemic awareness varies among the studies reviewed. Phonemic awareness refers to the ability to identify and consciously manipulate the phonemes in words (Adams, 1990; National Reading Panel [NRP], 2000). Phonological awareness is a more general term that includes rhyme and syllable detection as well as phonemic awareness (Torgesen, 1998). In this review, the terminology used by the authors will be maintained unless it is possible to determine from the description of the measures that the more specific term of phonemic awareness is appropriate.

This review of reading skills includes studies investigating predictors of reading achievement. Several studies have measured reading achievement broadly while others measured specific reading

skills such as decoding, word reading, fluency, or comprehension. Predictors of learning disability in reading or significant reading difficulty will be discussed in the second subsection.

Reading Achievement

Numerous studies have examined the relationship between early reading skills and later reading achievement. This section will highlight the results of eight longitudinal studies, literature reviews, or meta-analyses that analyzed the relationship between specific reading skills and later reading achievement. Early elementary factors such as phonemic awareness, rapid automatic naming (RAN), COP, phonological processing, and memory are discussed. Finally, research addressing the timing of early reading skills assessment related to later reading achievement is considered.

Duncan et al. (2007) conducted a series of regressions and a meta-analysis using the data from six large-scale longitudinal studies, including the ECLS-K study through the third grade data collection wave. The researchers examined students' early reading and math skills, attention, and socio-emotional behaviors and how these early factors relate to later school achievement. Broad measures of reading achievement, teacher ratings of overall reading performance, and grade retention were the reading-related student achievement outcomes. The results of the six regression analyses show that early reading skills consistently predicted later reading skills. Attention was also a significant predictor of later achievement in the analysis of several data sets. Socio-emotional behaviors were rarely statistically significant predictors of later achievement. Results of the meta-analysis found that school entry reading skills (.24), math skills (.26) and attention (.08) were significant predictors of the direct assessment of reading skills and teacher ratings of student reading performance. The specific analysis with the ECLS-K data found that early kindergarten reading skills were moderately correlated with the direct measure of third grade reading skills ($r = .56$) and teacher ratings of student reading skills ($r = .47$). The attention and socio-emotional results were discussed further in the section on social-academic behaviors.

The majority of the early reading measures used in the Duncan et al. (2007) analysis used broad measures of reading achievement in kindergarten. Identifying specific reading skills that are predictive of later reading achievement may provide better guidance for reading intervention and instruction. In a review of the literature on students who had not received formal reading instruction, Adams (1990) concluded letter knowledge and phonemic awareness skills were the most important predictors of later reading achievement. Although letter identification knowledge was an early indicator of later reading achievement, instruction focused on only improving letter knowledge did not result in subsequent improvement in reading achievement. Instead, early knowledge of the letters indicated a familiarity with print or the ability to learn without explicit instruction. Phonemic awareness (the ability to hear, identify, and manipulate sounds in words) is an important indicator of reading achievement because it signifies a student's awareness of the sounds within words and the ability to attend to those differences. Similar to letter naming, Adams concluded that instruction in phonemic awareness by itself does not ensure that a student will be a successful reader.

Many studies have examined the relationship between early reading skills and reading achievement in early elementary school, but it is also important to determine if this early relationship persists into late elementary school. Within the context of a school-wide research-based reading intervention program, Chard et al. (2008) examined a battery of student characteristics and skills as predictors of later oral reading fluency and high-stakes reading comprehension scores. The study sample consisted of students classified as at risk for later reading difficulties. Predictors included student demographic information, phonemic awareness, letter naming ability, alphabetic principle knowledge, and social skills (using the SSRS). Growth in oral reading fluency from kindergarten or first grade through third grade was significantly predicted by students' alphabetic principle knowledge in the spring of first grade and the interaction between alphabetic principle and teacher ratings of student competence in terms of academic performance, motivation, intellectual functioning,

and classroom behavior. Significant predictors of third grade reading and vocabulary composite scores included: gender, ethnicity, first grade problem behavior (negative association), fall phonemic segmentation fluency, spring phonemic segmentation fluency, spring passage comprehension, spring teacher ratings of academic competence, and oral reading fluency growth.

Scarborough's (1998) meta-analysis revealed that measures of reading readiness, letter identification, and concepts of print related to predictors of overall reading achievement (mean correlations ranged from .46 to .57). Other factors, such as the ability to recall the name an object, recall stories and sentences, language skills, and phonological awareness were also moderately correlated ($r = .45$ to $.46$) with overall reading achievement. IQ also had an average correlation of .41 with reading achievement. However, the research suggests that phonological awareness effectively predicts the good readers rather than the readers who will struggle. Studies that combined several reading-related factors that were individually predictive of reading difficulty were, on average, able to correctly classify 78% of at-risk students as later having reading difficulties. Three of the seven studies examined kindergarten predictors of first grade outcomes and three studies used kindergarten predictors to examine third grade outcomes.

In a recent study, Savage and Frederickson (2006) examined a number of early reading-related skills to predict later reading achievement. They investigated the role of early phonological processing, naming speed, memory, motor functioning, and handedness in later reading and spelling ability. When comparing the reading skills of below-average readers and average readers and below-average spellers and average spellers, the groups differed on measures of reading pseudowords, identifying which two of three presented words rhyme, and naming digits rapidly. Students did not differ on measures of rapid naming of pictures, short term or working memory, motor functioning, or handedness. This study indicates that reading and spelling difficulty are related to early measures of rhyming, non-word reading, and naming speed.

Hammill's (2004) review of three meta-analyses (including the Scarborough [1998] meta-analysis) provides support for the use of reading and writing skills as predictors of later reading achievement, rather than measures of memory or RAN. Hammill combined previously studied predictors of reading into ten categories or "Superordinate Ability Clusters" (Hammill, p. 454). The clusters with very large or large correlations with reading included previous reading, writing conventions, and letter knowledge. These three clusters were composed of a range of skills such as silent or oral reading, word recognition, nonsense word reading, reading comprehension, spelling, knowledge of capitalization and punctuation, conventions of print, letter naming, and making sound-symbol correspondences. In short, these early skills were all highly related to reading text. Hammill suggested that reading instruction focus on these skills. Other skills that had only moderate correlations with reading were written language, RAN, phonological awareness, intelligence and memory. Hammill concluded that reading screenings should focus on early concepts of print, letter knowledge, and writing skills rather than factors such as phonological awareness, rapid naming, and memory.

When a child's reading skills are assessed may have an impact on the predictive accuracy of early reading skills as they relate to later reading ability. Bishop (2003) investigated a combination of various reading-related skills at two different time periods in kindergarten to predict later reading achievement. Letter identification, phonological awareness, phonological memory, and RAN skills of 103 students were assessed in both the fall and winter of their kindergarten year. In an analysis of the scores, Bishop concluded that there was not an educationally relevant difference between the fall and the winter assessment periods in predicting end of first grade reading skills. Letter identification and phonological awareness were consistently the most effective predictors. These two factors, along with RAN and phonological memory, accounted for 57% of the variance from the fall measures and 60% from the winter measures in first grade oral reading fluency.

A follow up of the students in fourth grade revealed that letter identification, phonemic awareness, and RAN continued to be consistent and effective predictors of later oral reading fluency skills (Bishop & League, 2006). These kindergarten reading measures were not as effective at predicting later reading comprehension skills. From the winter screening, measures of picture RAN and color RAN were the most accurate predictors of which students had later reading difficulties (low levels of reading fluency), while the fall measures of phonemic awareness (phoneme elision, blending, and beginning and ending sound matching) were most accurate in predicting later reading difficulties with oral reading fluency. Overall, the fall screening yielded fewer false negatives of later reading difficulty than the winter screening. Bishop and League concluded that fall kindergarten assessments were comparable in predictive ability to winter kindergarten assessments. It is not necessary to wait to identify at-risk students.

In summary, early reading and reading related skills adequately predict later reading achievement (Savage & Fredrickson, 2006; Scarborough, 1998). A few studies have followed students beyond the third grade (Chard et al., 2008). While underlying processes such as phonemic awareness, RAN, and memory may be useful in predicting reading achievement, specific reading and writing skills are suggested to be the best predictors because they are more relevant to instruction (Hammill, 2004). There is some evidence that first grade reading assessments are more accurate than kindergarten assessments in predicting later reading achievement (Adams, 1990). Within the kindergarten school year, there appears to be modest differences between beginning and mid-year assessments (Bishop, 2003; Bishop & League, 2006). The disadvantage of waiting until first grade is the loss of educational time for early intervention.

Reading Difficulty

Investigations into predictors of reading difficulty or a learning disability include many of the early reading skills related to reading achievement. However, it has been difficult to accurately

identify which students will later experience significant reading difficulties (Scarborough, 1998; Snow et al., 1998). One confounding factor is the inconsistent use of terminology and definition of reading difficulty. A school-identified learning disability with IEP goals in reading is one classification for reading difficulty. Other studies defined reading difficulty as students scoring below a certain percentile on standardized reading measures (Lipka, Lesaux, & Siegal, 2006), students with the lowest reading scores compared to other students in their respective classroom (Torgesen, Burgess, & Rashotte, 1996), or students who do not demonstrate adequate progress in response to reading interventions (Al Otaiba & Fuchs, 2006). Another difficulty is the inherent heterogeneity in the population of students with reading difficulties (Fletcher et al., 2007). This section will discuss seven reviews, syntheses, or studies related to predictors of reading difficulty.

Using a combination of kindergarten student scores on measures of phonemic awareness skills, rapid naming, and letter-name knowledge, Torgesen et al. (1996) predicted which students would most likely be in the bottom 10% of reading skills in second grade compared to others in their classroom. At-risk kindergarteners were classified as scoring in the bottom 10% on the measures of phonemic awareness, rapid naming, and letter-naming. The researchers were able to identify those students who were at risk in kindergarten but did not demonstrate difficulty in second grade. However, the predictors were not as effective at correctly identifying the students who continued to have reading difficulty. By adjusting the definition of the at risk group to include the lowest 20 percent of students on the early reading measures, there was a dramatic decrease in the false negative rate. The implication of broadening the kindergarten at-risk group to include the lowest 20% of students meant that many students who did not need early intervention services would have received them.

Torgesen et al. (1996) and many other studies have focused on students' early reading difficulties, but fewer studies have examined reading difficulties that emerged in late elementary

school. Lipka et al. (2006) conducted a retrospective analysis of early differences in students' reading skills related to word attack, syllable and phoneme deletion, working memory, real word and pseudoword reading fluency, reading comprehension, and spelling. Pairs of students were selected to be included in the analysis. Each pair consisted of one fourth grade student whose reading achievement score was above the 30th percentile and one student who scored at the 25th percentile or lower. The same-gender pairs had similar kindergarten reading skills and English language skills and were in the same kindergarten classroom. With original sample sizes of 22 pairs, further subdivision of the reading difficulties group resulted in very small sample sizes. Individual students varied when they began to demonstrate reading difficulty. Several students had consistent difficulty in reading, but other students did not demonstrate reading difficulties until late in elementary school. Other students' reading scores fluctuated from above the 25th percentile to below the 25th percentile several times in elementary school.

Several studies have examined the characteristics of students who did not sufficiently improve in reading after receiving research-based instruction in elementary school. Al Otaiba and Fuchs's (2002) search of the literature from 1966 through mid-2000 yielded 23 relevant studies. In a majority of these studies, poor phonological awareness skills were indicative of students who did not make progress in reading during the intervention period. Some students who were not responsive to instruction also had lower scores on measures of phonological memory, phonemic discrimination, RAN and IQ.

Al Otaiba & Fuchs (2006) then examined the predictive ability of kindergarten measures of vocabulary, sentence imitation, word discrimination, rapid naming, and segmentation. The measures were effective in discriminating between students who were and were not responsive to a reading intervention. There were also statistically different scores on a teacher rating of classroom behavior. In a follow-up of students two years later, the majority of the remaining students who had not initially

responded to the intervention were receiving special education services with IEP goals in reading. This pattern indicates that lack of progress in reading is indicative of later special education identification.

Nelson et al. (2003) concluded that students with lower scores on measures of RAN and phonological awareness or higher teacher ratings of problem behaviors were less likely to demonstrate improvement in reading skills after receiving intensive reading intervention. Knowledge of the alphabetic principle and memory also had 95% confidence intervals around the effect size that did not include zero, indicating a statistically significant relationship. RAN and phonological awareness were more related to treatment effectiveness than the alphabetic principle knowledge. The role of behavior was discussed in the previous section on social-academic behavior.

Students with reading difficulties share many similar characteristics, but there is variability in the individual reading skills of students with reading difficulties. Fletcher et al.'s (1997) analysis of several studies suggests possible subtypes of reading difficulties. Some students with reading difficulties experience phonological awareness difficulties, while other struggling readers do not. These differences within the subpopulation may have implications for intervention; students with varying needs will respond differently to interventions depending on their reading skills. In addition, there may be another factor or a combination of factors that indicate reading difficulties besides reading skills.

Predictions based only on early reading skills do not effectively identify a sufficient number of students who will later have reading difficulty. Students who should be identified as at risk are often missed (low sensitivity of the predictors), and at the same time students are identified as at risk, but do not have later reading difficulties (low specificity of predictors) (McCardle et al., 2001). In their review of different models of reading difficulties, McCardle et al. concluded that early reading skills (i.e. letter identification) identify about half of the students do have later reading difficulties.

The authors noted that is also important to consider motivation and responsiveness to instruction. How students' reading skills interact with their other characteristics and the classroom instruction will be necessary to effectively determine which students are most at-risk of later reading difficulty.

Felton (1992) used early kindergarten measures of phonological awareness, rapid automatic naming, and memory to predict student performance on a third grade group-administered reading vocabulary and comprehension test. Kindergarten measures of alphabet naming speed, beginning sound discrimination, and phoneme manipulation explained 38% of the variance on the third grade reading measure, when excluding a measure of intellectual capacity. Using stepwise discriminant function analysis, these measures also correctly classified all of the students scoring at the 5th percentile or below in third grade and 76% of the students who scores ranged from the 6th to the 16th percentile in third grade.

Phonemic awareness, RAN, and concepts about print are consistent predictors of reading difficulty or limited response to research-based interventions (Adams, 1990; Nelson et al., 2003; Scarborough, 1998; Torgesen et al., 1996). However, some students do not initially demonstrate reading deficits, but experience reading difficulty in later elementary school (Lipka et al., 2006). Therefore, it is difficult to accurately identify the students who have reading problems in later elementary school without including many students in the at-risk group who later do not struggle with reading.

Summary

The alphabetic principle and other reading related skills such as concepts about print, text knowledge, and the sound-symbol relationship are important early indicators of later reading achievement (Adams, 1990; Scarborough, 1998). RAN and phonemic awareness are also used to identify the students who do not respond to intensive reading instruction and experience reading difficulty (Al Otaiba & Fuchs, 2006; McCardle et al., 2001; Nelson et al., 2003; Torgesen et al.,

1996). Additional factors implicated in Hammill's (2004) review of meta-analyses, including written expression, writing skills, and a variety of other reading skills, are not consistently included in the examination of characteristics of non-responders.

Reading Instruction

Reading instruction is an important component to consider in the prediction of LDR. The type, intensity, and effectiveness of reading instruction can impact the reading ability of students (Snow et al., 1998). Although some students are able to learn to read with little formal reading instruction, many students require instruction and guidance to become proficient readers. There has been a long standing sentiment that beginning reading instruction too early is detrimental to later reading success and enjoyment (Hanson & Farrell, 1995). However, in their analysis of students' reading achievement, reading habits, and remediation, Hanson and Farrell found that high school seniors who had participated in kindergarten programs with 20-30 minutes of reading instruction a day for 25 weeks had better reading-related outcomes than students who were in comparable kindergarten programs without the reading component. A strong reading instructional foundation in kindergarten can have a lasting impact.

Classroom reading instruction has changed over time with fluctuations in what was considered to be effective instruction based on a variety of scientific and societal changes (Smith, 2002; Tracey & Morrow, 2006). For example, in the 1960s, teachers reported commonly using three skill-based groups when teaching reading (Baumann, Hoffman, Duffy-Hester, & Ro, 2000). Teachers at the end of the 20th century described their classroom reading instruction as balanced and eclectic, having whole class reading instruction with small flexible reading groups. The surveyed teachers also reported greater access a variety of books for reading instruction than in previous decades (Baumann et al). In the 1998-1999 school year, kindergarten teachers reported frequently using a combination of phonics instruction and integrated language arts (Xue & Meisels, 2004).

The quality of reading instruction is a concern of effective reading instruction. In an analysis of kindergarten, first grade, and third grade instructional practices surveyed in the ECLS-K study, instruction did not predict reading achievement for public and private school students with learning disabilities (Matthews, 2007). A limiting factor of the ECLS-K data set is the lack of information about specific students' (those with LD) participation in the general education classroom (Matthews) or the quality of the instruction the students received. Torgesen et al. (1999) noted that although teachers in their study reported using phonics instruction, the teachers' characterization of reading instruction may not meet the criteria of explicit and systematic instruction. Al Otaiba and Fuchs (2002) stated in their review of the intervention literature that few studies reported on the efficacy of reading interventions. The effectiveness of reading instruction and interventions may contribute to the student outcomes more than just a categorical description of the type of instruction provided to the students. The lack of information on how well an intervention or instructional program was conducted is a noted limitation of research on reading instruction overall.

This section will review the literature related to what is currently known about effective classroom and intervention reading instruction. First, general reading instruction guidelines from the National Reading Panel's report are reviewed. Then, classroom and small group instructional practices specifically recommended for students who are at risk for or experiencing reading difficulties will be discussed.

The National Reading Panel's Report

The National Reading Panel's report (2000) is a highly influential compilation of reading research. The Panel conducted a series of meta-analyses and reviews examining the effectiveness of a variety of reading instructional strategies and methods. The reports of the Panel subgroups on alphabets, fluency, and comprehension will be reviewed.

Each subgroup reviewed the pertinent literature to draw conclusions regarding effective instructional practices. Five areas of reading instruction were identified: phonemic awareness, phonics, fluency, vocabulary, and comprehension. Phonemic awareness training had moderate effect sizes related to reading and spelling skills, especially for emergent readers. Phonemic awareness instruction was beneficial, especially for young, struggling readers. Systematic phonics instruction had a moderate effect on reading outcomes; however, the effect was not consistent across all areas of reading. Phonics instruction had a greater impact on spelling and decoding skills and less of an impact on comprehension. The effect size for synthetic phonics instruction was larger compared to other methods, but there were no statistically significant differences in the meta-analysis among the three approaches of systematic phonics instruction. The alphabetics subgroup researchers noted that phonics instruction was particularly effective for early elementary school students with a disability or at risk for later reading difficulty. Oral reading with specific feedback about student performance and repeated readings were related to an increase in both fluency and comprehension scores of students. A meta-analysis was not conducted for vocabulary and comprehension instruction due to substantial differences in methodology, conceptualization of the topics, and implementation of strategies across the individual studies. As a result, only broad recommendations were provided. Recommendations for vocabulary instruction included providing numerous repetitions of the new words and direct instruction in word meaning. Studies also showed that students effectively learned new vocabulary through repeated reading or incidental exposure to words. Eight recommendations for comprehension instruction were made including strategies such as: monitoring comprehension, summarizing, cooperative learning, using organizers, evaluating story structure, and asking and answering questions. The Panel recommended that students receive instruction through a variety of methods including computer-based instruction.

There has been criticism of the NRP report and about the research related to phonemic awareness and phonics instruction specifically. The minority view of the NRP subcommittee argued that the Report was prepared hastily, did not cover a large enough scope of reading, and was not of practical use to educators (NRP, 2000). The analysis and recommendations for phonics instruction specifically came under scrutiny, particularly the limited research-based relationship between phonics and comprehension (Camilli & Wolfe, 2004). Too much early emphasis on phonics detracted from the overall goal of making meaning from text. Not specifically related to the NRP's report, Torgesen (1999) has also argued that more research is needed to determine if there is a relationship between systematic phonemic awareness training and direct phoneme-based reading instruction and reading comprehension.

The main foci of reading instruction should include five components: phonemic awareness, phonics, fluency, vocabulary, and comprehension. More research is needed in these areas, particularly with the relationship of phonics and phonemic awareness to comprehension. Students' reading instruction in the general education classroom should include these five components to ensure that students are learning to decode the words in text and understand what they are reading.

Reading Difficulty

Longitudinal studies and reviews of the literature have been helpful in understanding the short and long-term impacts of specific types of reading instruction. This section will begin with a discussion of three recent summaries of reading instruction for students with reading difficulties or learning disabilities. The reviews include some overlapping bodies of research. Next, individual studies that specifically focus on reading instruction for struggling elementary school readers will be reviewed.

Adams' (1990) extensive analysis of reading research through the 1980s indicated that explicit and systematic phonics instruction is beneficial for teaching young readers and those who are

struggling to learn how to read. Providing phonics instruction in conjunction with reading connected text and comprehension instruction lead to the greatest reading achievement gains. The specific type of phonics instruction may not be as important as the method in which it is taught: enthusiastic teachers who buy into the program and who are using a novel approach may have better results.

Swanson's (1999) meta-analysis of studies published from 1963 to 1997 included students or adults with learning disabilities who received supplemental reading instruction. Interventions were classified into one of four reading models: direct instruction, strategy instruction, combined (both direct instruction and strategy instruction), or neither type of instruction. Direct instruction programs included task analysis of the lesson steps, teacher feedback, independent student practice, small group instruction, and teacher modeling. Strategy instruction included using advanced organizers, elaboration and summarization techniques, study skill strategies, metacognition training and self-evaluation. Overall, interventions that used direct instruction approaches to teaching word identification had the largest positive effect size. Students who received both strategy instruction and direct instruction made the greatest gains in reading comprehension.

Using the ECLS-K data, Xue & Meisels (2004) investigated the relationship of kindergarten reading instruction and achievement. The researchers included 26 reading instructional practices from the kindergarten teacher self report in an exploratory factor analysis using Rasch scaling methods. Two instructional factors were created: phonics and integrated language arts. There were differences in kindergarten students' reading growth depending on initial reading scores and the type of instruction (phonics or integrated language arts) students frequently received. Students who began the school year with higher levels of reading skills demonstrated more growth in classrooms with more integrated language arts instructional compared to students with lower levels of initial reading scores. There was not a difference in kindergarten reading growth with different levels of phonics instruction.

Overall, kindergarteners with the most reading growth had teachers who reported high levels of both integrated language arts and phonics instruction.

Al Otaiba et al. (2008) used hierarchical linear modeling to examine the relationship between kindergarten instruction and student reading achievement as measured by letter knowledge and phonological awareness. Kindergarten teachers used reading programs by *Scott Foresman*, *Open Court*, *Reading Mastery*, or *Harcourt* at eight elementary schools. Teacher instructional practices were observed on three occasions and were coded as being explicit and individualized instruction or meaningful instruction related to text. In general, kindergarten teacher instruction remained relatively consistent over the course of the school year during the three observations. The specific program (i.e. *Scott Foresman*) was not related to later measures of student achievement. The teachers in the study spent very similar amounts of time on phonics and phonological awareness instruction. Any differences in the amount of code-based instruction were not reflected in differences in reading-related outcomes, suggesting that once a sufficient amount of effectively implemented code-based instruction is provided, any additional amount is not providing additional benefit for kindergarten students. Students with low scores on measures of vocabulary had better letter naming-decoding fluency, vocabulary, and comprehension outcomes in classrooms with more vocabulary and comprehension instruction.

In a kindergarten to first grade longitudinal study, Scanlon and Vellutino (1996) examined how a battery of early kindergarten reading-related skills and reading instruction practices in half-day and full-day kindergarten classes related to first grade reading achievement. Letter-identification was the single most effective kindergarten factor in accounting for the variance in first grade reading achievement. Students with limited letter identification skills demonstrated the best outcomes in classrooms with a greater amount of phonemic awareness activities.

A number of specific reading programs and instructional methods have been shown to be effective for teaching struggling readers. Fletcher et al. (2007) reviewed three reading methods: Direct Instruction (DI), explicit supplemental reading instruction, and Peer-Assisted Learning Strategies (PALS). The DI reading programs include a teacher-directed, scripted lesson plan with a behavior management system. The curriculum addresses phonics, fluency and comprehension. In general, studies of DI programs have yielded large, positive effect sizes for student outcomes on measures of overall reading, individual word reading, and passage comprehension. Fletcher et al. also reviewed a study by Foorman et al. (1998). This study investigated the reading skills of first and second graders attending schools receiving Title I funds. Students received one of three types of instruction within the context of a "literature-rich environment" (Foorman et al., p. 39): (a) decodable text with focus on letter-sound correspondence, (b) connected text with focus on spelling patterns, or (c) connected text with incidental instruction in phonics. Growth curve analysis showed that students in the instructional group with explicit instruction in the letter-sound correspondence demonstrated significantly more phonological processing and word reading growth than students in other groups. This was particularly true for students with fewer phonological processing skills at the beginning of the intervention. In general, students who received instruction in spelling patterns demonstrated greater reading gains than students who received incidental phonics instruction. Students who received more explicit instruction in sound-symbol correspondence made the most reading gains. The third classroom program reviewed by Fletcher et al. was the PALS program. Heterogeneous pairs (based on a rapid naming task) of students worked together several times a week on reading skills. The use of the PALS program yielded student gains in word recognition, reading fluency, and comprehension for both low and average performing students. Fletcher et al.'s review concluded that these structured reading interventions effectively increased the early reading skills of many students with early reading difficulties.

Comparisons among students receiving different types of supplemental reading instruction suggests direct and explicit instruction in decoding skills is the most beneficial for students struggling to learn to read (Al Otaiba et al., 2008; Fletcher et al., 2007). Strategy instruction is also beneficial when teaching students to comprehend text (Swanson, 1999).

Summary

Reading instruction for elementary school students should include five components: phonemic awareness, phonics, fluency, vocabulary, and comprehension (NRP, 2000). Peer interventions and flexible teacher-determined curricula can be helpful for struggling readers – at least in the short-term (Fletcher et al., 2007). In general, systematic and explicit instruction is consistently more effective than other instructional approaches for teaching students with reading difficulties (Adams, 1990; Swanson, 1999).

Conclusion

Predictors of a Learning Disability in Reading

Substantial research has been conducted in the areas of age at time of kindergarten entry, social academic behaviors, reading skills, and reading instruction and how these factors relate to reading achievement and struggling readers. Overall, the research shows that age at time of kindergarten entry does not have a substantial impact on reading achievement of students as a group (McCoach et al., 2006; Morrison et al., 1997; Shepard & Smith, 1986; Yesil-Dagli, 2006); however, younger students in their respective grades are more likely to be identified with a learning disability (Martin et al., 2004) or referred for special education (Tarnowski et al., 1990). Although there were no statistical differences on age-based standardized tests, teachers may perceive younger students as more immature and less academically capable compared to the older students in the elementary school classroom (NICHD, 2007). Social-academic behaviors have a small but significant relationship with reading achievement (Duncan et al., 2007; McClelland et al., 2006). Students with

learning disabilities often demonstrate deficits in the classroom behaviors necessary to benefit from instruction (Bender & Smith, 1990; McKinney et al., 1982; McKinney & Speece, 1986; Osborne et al., 1991). Students who were resistant to intensive reading interventions often had lower ratings of appropriate classroom behavior (Al Otaiba & Fuchs, 2002; Nelson et al., 2003). Early reading skills are moderately predictive of later reading achievement (Chard et al., 2008; Duncan et al., 2007), but early reading skill alone does not adequately predict the students who are most likely to have reading difficulties later (McCardle, et al., 2001; Scarborough, 1998; Snow et al., 1998; Torgesen et al., 1996). Phonemic awareness skills, knowledge of the letters of the alphabet, RAN, and concepts about print are a few of the more reliable early reading skill predictors (Bishop & League, 2006; Scarborough; Torgesen et al.). Students having difficulty with decoding and limited vocabulary knowledge had better outcomes in classrooms with systematic, explicit, and direct instruction in the sound-symbol relationship (Adams, 1990). The literature supports the inclusion of these multiple factors to predict difficulty learning to read and the school identification of a learning disability with IEP goals in reading.

ECLS-K Studies

Many studies have been conducted with the ECLS-K data set to address a variety of education and child development related questions. Specifically within the ECLS-K data set, 3.26% of students in third and 6.49% of students in fifth grade were identified as having a learning disability (U.S. Department of Education National Center for Education Statistics [USDE NCES] 2007). Overall reading achievement in third grade was related to both early reading skills and classroom behavior (Duncan et al., 2007; Mills, 2007). Kindergarten students with higher reading skills had better outcomes in classrooms with integrated language arts instruction (Xue & Meisels, 2004). The reading achievement of students with learning difficulties, however, was not related to classroom instructional practices (Matthews, 2007). Several studies examined age at time of kindergarten entry,

but came to separate conclusions about the relationship between age at time of school entry and achievement (Fleischman, 2007; McCoach et al., 2006; Yesil-Dagli, 2006). The ECLS-K data has also been used to examine other school-related issues including the relationship between SES and school achievement (Hair et al., 2006), school retention policies and achievement (Hong & Raudenbush, 2005), and retention and delayed school entry and achievement (Malone, West, Flanagan, & Park, 2006).

The data from the ECLS-K provides a wealth of information useful to investigate questions related to early school performance and instruction. Because of the information collected on students with disabilities, it provides a unique opportunity to investigate predictors of school identified learning disability with IEP goals in reading.

CHAPTER 3 – METHODOLOGY

The research hypotheses were tested by analyzing the kindergarten, third and fifth grade data collection waves of the ECLS-K. The longitudinal nature of the ECLS-K database provides a unique opportunity to study a range of individual and instructional factors associated with school performance, including school identification of a learning disability with Individual Education Program goals in reading. The initial study was conducted by the U.S. Department of Education and the National Center for Education Statistics, along with Westat and the Educational Testing Service (USDE NCES, 2000). Numerous federal agencies were involved with the longitudinal study, including the Office of Special Education Programs (IES, 2008).

The ECLS-K data were collected from participating students and their parents, teachers, and schools related to the students' cognitive, social, emotional, and physical development (USDE NCES, 2000). The data set also includes information about the students' home environments, school environments, classroom environments, and classroom curricula. Data collection points for the full sample of students from the ECLS-K study were the fall and spring of kindergarten (1998-99), spring of first grade (2000), spring of third grade (2002), and spring of fifth grade (2004) (USDE NCES, 2006). In the fall of first grade, data about students' learning and experiences during the summer between kindergarten and first grade were collected on 30% of the study population.

The present study analyzed the restricted-release data in order to examine specific information related to students' identified disabilities. The applicable Institute of Education Sciences guidelines and security protocols were followed for the restricted-release data. Approval from the Institution Review Board for the Use of Human Subjects in Research was received.

This research study included only public school students since IDEA requirements for identification and provision of special education services apply only to public schools receiving federal funds.

Sample Selection

The ECLS-K selected a large, nationally representative cohort of public and private school kindergarten students ($n = 21,260$) using a multistage probability sample design (USDE NCES, 2000). Geographic areas of the United States were divided into 1,404 primary sampling units (PSUs) and 100 were chosen. Over 900 public schools, including year-round schools, were selected. In January of 1998, letters detailing the ECLS-K objectives and data collection procedures were sent to the 41 state test directors of the schools selected from the sampling frame. Each state test director then provided guidelines on how to contact the school districts of the identified schools. ECLS-K staff contacted 584 public school districts and 438 (75%) agreed to participate. After obtaining permission from the district superintendent, a letter was sent to the administrators of each sampled school to explain the study.

Each school administrator identified a school coordinator who communicated with the ECLS-K staff (USDE NCES, 2000). In September 1998, each school coordinator provided an ECLS-K field supervisor with a list of the kindergarten students' names. The ECLS-K field supervisor sampled approximately 24 students from each school with a purposeful over selection of Asian/Pacific Islander students (2.5-3 times more than the rate of other students). If one twin was randomly selected to be in the study, then the second twin was also included in the study. Half of the students were selected to be followed if they moved from their original school. The Westat Telephone Research Center used a variety of strategies to contact the relocated families with varying levels of success. In the third grade data collection wave, 13,166 public school students were able to be included in the ECLS-K study. By fifth grade, only 9,567 public school students were still eligible for study participation (USDE NCES, 2006).

The individual schools determined the procedure used by ECLS-K to acquire participant consent (USDE NCES, 2006). Implicit consent was obtained from the participants at about half of the

schools. In this instance, a form was sent to each selected student's home. Parents only returned the form if they did not want their child to participate in the study: the absence of a returned form indicated consent. Explicit consent required parental signature on the permission form prior to the student's direct cognitive assessment date. The ECLS-K staff made multiple attempts to obtain parent consent.

Data Collection Procedures

ECLS-K data collection teams consisted of four people: a field supervisor and the three assessors who were in direct contact with each school. There were a total of 112 field supervisors and 343 assessors collecting ECLS-K information during the students' kindergarten year (USDE NCES, 2000). ECLS-K assessors had previous experience with other large-scale studies and participated in extensive training. Assessors individually reviewed information related to the study design, the direct child assessment, and interview techniques. They also attended a five-day training on how to conduct the direct child assessment (including the reading assessment). Field supervisors received the same training plus instruction on the field management data collection system.

Kindergarten School Year

An ECLS-K staff member administered the reading and mathematics assessments between September and early December of 1998 (USDE NCES, 2000). At most schools, the direct cognitive assessment period lasted 16 weeks. Data were obtained in year-round schools during multiple assessment periods. Each student was individually assessed in the library or a school classroom during one 50 to 70 minute session. ECLS-K assessors used computers to assist with determining the next question to ask depending on the students' responses. Field supervisors observed each assessor on one occasion to determine if the assessor built rapport with the student and followed the appropriate procedures.

Approximately 90% of kindergarten students completed the direct cognitive assessment (USDE NCES, 2000). School records were used to determine student home language. Students who primarily spoke a language at home other than English had to demonstrate proficiency on the ECLS-K study's oral language development measure before they were given the direct assessment. Students who required an alternate format of the assessment (e.g. Braille, large print, or sign language) or had a provision in their IEP excluding them from standardized tests did not participate in the assessment.

The 50-minute parent interviews were conducted between September 1998 and January 1999 (USDE NCES, 2000). Most parents participated in telephone interviews. For individuals without a telephone, parents were interviewed in person. The majority of the interviews were conducted in English (approximately 93%). Bilingual ECLS-K staff interviewed parents in Spanish (the majority), Lakota, Hmong, or Chinese, as necessary. ECLS-K staff determined that 1% of parent interviews could not be completed due to language difficulties. Later, field supervisors validated basic socio-demographic information and asked parents to re-answer 8-10 questions. Approximately 84% of participating students had complete parent interviews. Participating parents received a thank you letter and an educational activities booklet.

In the fall of 1998 and again in the spring of 1999, questionnaires were distributed to kindergarten teachers (USDE NCES, 2000). Teachers who did not return the surveys were contacted by phone or in person. The questionnaire consisted of three parts: (A) information about the classroom, (B) information about the teacher and his/her views on teaching and the school, and (C) information about the student selected to participate in the study. Ratings of student social-academic behavior were completed as part of this questionnaire in the fall. From the spring questionnaire, this study used data from Part A for the survey of instructional practices and Part C for individual student early intervention participation. The reading instruction items are included in Tables 2 and 3.

Teachers were paid five dollars for completing Part C of the questionnaire. The completion rate for Part C was 91.3% in the fall and 85.3% in the spring (USDE NCES).

The school administrator’s questionnaire was completed (84.3% return rate) between March and June of 1999 (USDE NCES, 2000). This questionnaire included information about the start date of school.

Table 2

Kindergarten Teacher Questionnaire: How Often do Children in this Class do Each of the Following Reading and Language Arts Activities?

Variable Name	Reading and Language Arts Activities
A2LERNLT	Work on learning the names of the letters
A2PRACT	Practice writing the letters of the alphabet
A2NEWVOC	Discuss new or difficult vocabulary
A2DICTAT	Dictate stories to a teacher aide, or volunteer
A2PHONIC	Work on phonics
A2SEEPRI	Listen to you read stories where they see the print (e.g., Big Books)
A2NOPRNT	Listen to you read stories but they don’t see the print
A2RETELL	Retell stories
A2READLD	Read aloud
A2BASAL	Read from basal reading texts
A2SILENT	Read silently

Table 2 continued

Variable Name	Reading and Language Arts Activities
A2WRKBK	Work in a reading workbook or on a worksheet
A2WRTWRD	Write words from dictation, to improve spelling
A2INVENT	Write with encouragement to use invented spelling, if needed
A2CHSBK	Read books they have chosen for themselves
A2COMPOS	Compose and write stories or reports
A2DOPROJ	Do an activity or project related to a book or story
A2PUBLISH	Publish own writing
A2SKITS	Perform plays and skits
A2JRNL	Write stories in a journal
A2TELLRS	See/hear stories from story tellers or other artists
A2MXDGRP	Work in mixed-achievement groups on language arts activities
A2PRTUTR	Peer tutoring

Table 3

Kindergarten Teacher Original Questionnaire: For this School Year as a Whole, Please Indicate How Often Each of the Following Reading and Language Arts Skills is Taught in Your Class.

Variable Name	Reading and Language Arts Skill
A2CONVNT	Conventions of print (left to right orientation, book holding)
A2RCGNZE	Alphabet and letter recognition
A2MATCH	Matching letters to sounds
A2WRTNME	Writing own name (first and last)
A2RHYMNG	Rhyming words and word families
A2SYLLAB	Reading multi-syllable words, like adventure
A2PREPOS	Common prepositions such as over and under, up and down
A2MAINID	Identifying the main idea and parts of a story
A2PREDIC	Making predictions based on text
A2TEXTCU	Using context cues for comprehension
A2ORALID	Communicating complete ideas orally
A2DRCTNS	Remembering and following directions that include a series of actions
A2PNCTUA	Using capitalization and punctuation
A2COMPSE	Composing and writing complete sentences
A2WRTSTO	Composing and writing stories with understandable beginning, middle, end
A2SPELL	Conventional spelling
A2VOCAB	Vocabulary
A2ALPBTZ	Alphabetizing
A2RDFLNT	Reading aloud fluently

Third and Fifth Grade School Years

In the spring of 2002 and again in 2004 general education teachers completed a teacher questionnaire similar to the one completed by the kindergarten teachers. In Part C, teachers indicated if a student had received instruction and/or related services in a special education program. Between January and June of those years, special education teachers completed a two-part ECLS-K questionnaire that had been mailed to the school coordinators (USDE NCES, 2006). The data used in the present study were from Part B, which included information related to the student's disability classification and IEP goals.

Research Variables

Independent Variables

The specific variable codes from the ECLS-K dataset and the subsequent derived variables used in this study are presented in Table 4.

Table 4

Study Variables, Definitions, and Corresponding ECLS-K Variables

Study variable	Definition	ECLS-K variables
KAGE	Student age on first day of kindergarten	DOBYY
	Continuous	DOBMM
		DOBDD
		U2SCHBYY
		U2SCHBMM
		U2SCHBDD
KFSABEH	Social-academic behavior from the Approaches to Learning subscale; Continuous	T1LEARN
KFKREADT	Early reading skills, <i>t</i> -score Continuous	C1RRTSCO
FAC3_1	Regression scale score from the exploratory factor analysis	See Tables 2,3, & 5
LDR3	Learning disability with IEP goals in reading at third grade	E5PRMDIS
	Dichotomous	E5IEPRDG
		T5SPEDRE
LDR5	Learning disability with IEP goals in reading at fifth grade	E6PRMDIS
	Dichotomous	E6IEPRDG
		G6SPEDRE
FTIMEK98	Known first time kindergartener Categorical	P1FIRKDG

Table 4 continued

Study variable	Definition	ECLS-K variables
PUBLIC3	Attended public school at third grade Dichotomous	S5PUPRI
PUBLIC5	Attended public school at fifth grade Dichotomous	S6PUPRI
C1_5FCO	Child level analytic weight at third grade	C1_5FCO
C1_6FCO	Child level analytic weight at fifth grade	C1_6FCO
C1_5FC1 – C1_5FC90	All replicate weights at third grade	C1_5FC1 – C1_5FC90
C1_6FC1 – C1_6FC90	All replicate weights at fifth grade	C1_6FC1 – C1_6FC90

Age at the start of kindergarten. Student age on the first day of kindergarten is derived from six reported variables. The school start date was collected from the school administrator's questionnaire completed in the spring of kindergarten. The child's birth date was collected from the kindergarten fall parent interview. If the parent interview data did not contain the student birth date or the interview was not conducted, date of birth was obtained from the field management system of the ECLS-K study (USDE NCES, 2000). If the start date of school was missing, September 1, 1998 was used. A series of transformations were performed to derive the student age in months at the start of the kindergarten school year.

Reading. An ECLS-K assessor conducted the direct cognitive measure with each eligible child in the fall of kindergarten (USDE NCES, 2000). The reading measure created for the ECLS-K study assessed basic reading skills, vocabulary, and comprehension including identifying letters of the

alphabet, associating letters with beginning sounds, associating letters with ending sounds, recognizing common sight words, and reading in context. Students first completed a 12-20 item routing test that determined the difficulty level of subsequent questions. Several permutations of the reading score are available through the ECLS-K data set. Fall of kindergarten *t*-scores, with a mean of 50 and a standard deviation of 10, were used in this analysis. These scores are derived from the item-response theory reading scores and indicate how a student performed on the measure compared to his or her peers. The reliability estimates for the reading assessment in the fall of kindergarten (round 1) was .91 (Rock & Pollack, 2002).

Social-academic behavior. Kindergarten classroom teachers completed the Social Rating Scale (SRS) in the fall of kindergarten using a 4-point Likert-type scale (1-never to 4-very often; no opportunity to observe; USDE NCES, 2000). The SRS was based on the Social Skills Rating System (SSRS) by Gresham and Elliot (1990). The SSRS is a comprehensive assessment of social skills (Demaray et al., 1995) that has been shown to discriminate between students with disabilities and students without disabilities, but not between disability types (i.e. learning disability and mental retardation; Bramlett, Smith, & Edmonds, 1994).

Unlike the three subscales of the SSRS, the SRS includes five subscales and does not provide a measure of academic proficiency. The five subscales, created from the SSRS based on exploratory and confirmatory factor analyses conducted by the ECLS-K staff, include: (1) Approaches to Learning, (2) Self-Control, (3) Interpersonal Skills, (4) Externalizing Problem Behaviors, and (5) Internalizing Problem Behaviors (USDE NCES, 2000). Subscales 1-3 have high levels of multicollinearity ($r = .65$ or higher) (Rock & Pollack, 2002). An a priori decision was made to use the Approaches to Learning subscale. This subscale includes six variables related to social-academic behaviors: (1) student attentiveness, (2) task persistence, (3) eagerness to learn, (4) learning independence, (5) flexibility, and (6) organization (USDE NCES). The mean score was reported, with

a range from 1 to 4. Higher scores on the Approaches to Learning subscale indicate more positive behavior.

Reading instruction. Kindergarten teachers completed a self-report designed by the ECLS-K study team related to classroom reading instruction practices (USDE NCES, 2006). The teachers rated the frequency of specific instructional practices and activities such as: concepts about print, rhyming words, working on phonics, reading silently, and making predictions (See Tables 2 and 3). There were 42 statements related to instructional practices and classroom activities. The instructional practices 7-point Likert-type scale was transformed to be consistent with the 6-point Likert-type scale used for classroom activities by combining scores of 1 (taught at a higher level) and 2 (children should already know) and adjusting the other ratings. The final scale included: (1) never, (2) once a month or less, (3) 2-3 times a month, (4) 1-2 a week, (5) 3-4 times a week, and (6) daily.

An exploratory factor analysis was conducted to derive factors related to teaching activities and methods. Visual inspection of histograms with a superimposed normal curve indicated that several instruction variables were skewed or had bimodal distributions. Many variables had calculated z -scores well beyond three standard deviations from the mean (0), a common occurrence with large sample sizes (Field, 2005). The use of principal axis factoring was appropriate (Osborne, Costello, & Kellow, 2008). Varimax, an orthogonal rotation, was used to provide a better fit of the data (Field, 2006) since varimax rotations provide a “clearer separation of the factors” (Kim & Mueller, 1978, p. 36,).

Data from teachers who did not complete the relevant section of the teacher survey or who left a majority (more than 75%) of the items blank were excluded from the analysis. If less than 25% of the items had missing data, the instructional practice was recoded as “Never” occurring (1).

Factor analysis with principal axis factoring was conducted multiple times to determine the most appropriate number of factors to include in the final model. Several indicators were used to

ascertain if the use of a factor analysis with this set of variables was appropriate and if the model was a good fit for the data. The Bartlett's test was significant ($p < .000$), indicating a good fit of the data (Field, 2005). The overall Kaiser-Meyer-Olkin (KMO) statistic also aided in determining if a factor analysis was an appropriate method to summarize the data (Field). The initial factor analysis yielded a high KMO value (.91), which supported the use of a factor analysis method to summarize the data (Field). Two variables had individual KMO values in the anti-image correlation matrix lower than .5: KINVENT(.49) and KCOMPSE (.43), suggesting that these variables may not be appropriate to include. Removing the two variables from the analysis resulted in a slight decrease of the overall KMO statistic (.90). The two variables were retained in the analysis since the overall KMO was high, and the variables were important to the understanding of the reading instruction occurring in kindergarten classrooms.

The correlation matrix also provided support for the factor analysis with the data: the majority of the off-diagonal correlations between the variables were very small and most correlations had 1-tailed significance levels of .05 or less. No variable pairs had correlation coefficients greater than .9, which would have suggested "singularity in the data" (Field, 2005, p. 648). In the initial model, there were 18 (2.0%) nonredundant residuals with absolute values less than .05. Using the Kaiser criterion as a guideline, there were 10 factors with eigenvalues greater than 1 in the initial analysis with the unrotated solution. Six of the ten factors had fewer than three variables with loadings greater than .3 on the factor matrix. Factors should have at least three variables with loadings greater than .3 (Osborne et al., 2008).

The initial varimax rotation that maintained factors with eigenvalues greater than 1 included two factors with few high variable loadings. Since there were more than 30 variables and the majority of the communalities were less than .6, the use of the eigenvalues to determine the number of factors

was not appropriate (Field, 2005). The scree plot was used to determine the appropriate number of factors. A dramatic leveling off on the scree plot occurred after three factors (see Figure 1).

The principal axis factor analysis with varimax rotation keeping three factors yielded 162 (18.0%) nonredundant residuals with absolute values less than .05. This indicated that the model was still a good fit for the data (Field, 2005). Factor 3 was highly associated with several instructional practices related to the sound-symbol relationship and phonics instruction. Table 5 displays the variables with high loadings ($> .3$) on factor 3. The three factors cumulatively accounted for 27.13% of the variance on the rotation sums of squared loadings. Factor 3 individually accounted for 6.4% of the variance. Factor 1 was most associated with variables related to meaning-based instruction (i.e. write stories in journals, make predictions, use context clues). Factor 2 was associated with advanced instructional practices and activities compared to the standard kindergarten curriculum (i.e. reading aloud fluently, using conventional spelling, alphabetizing).

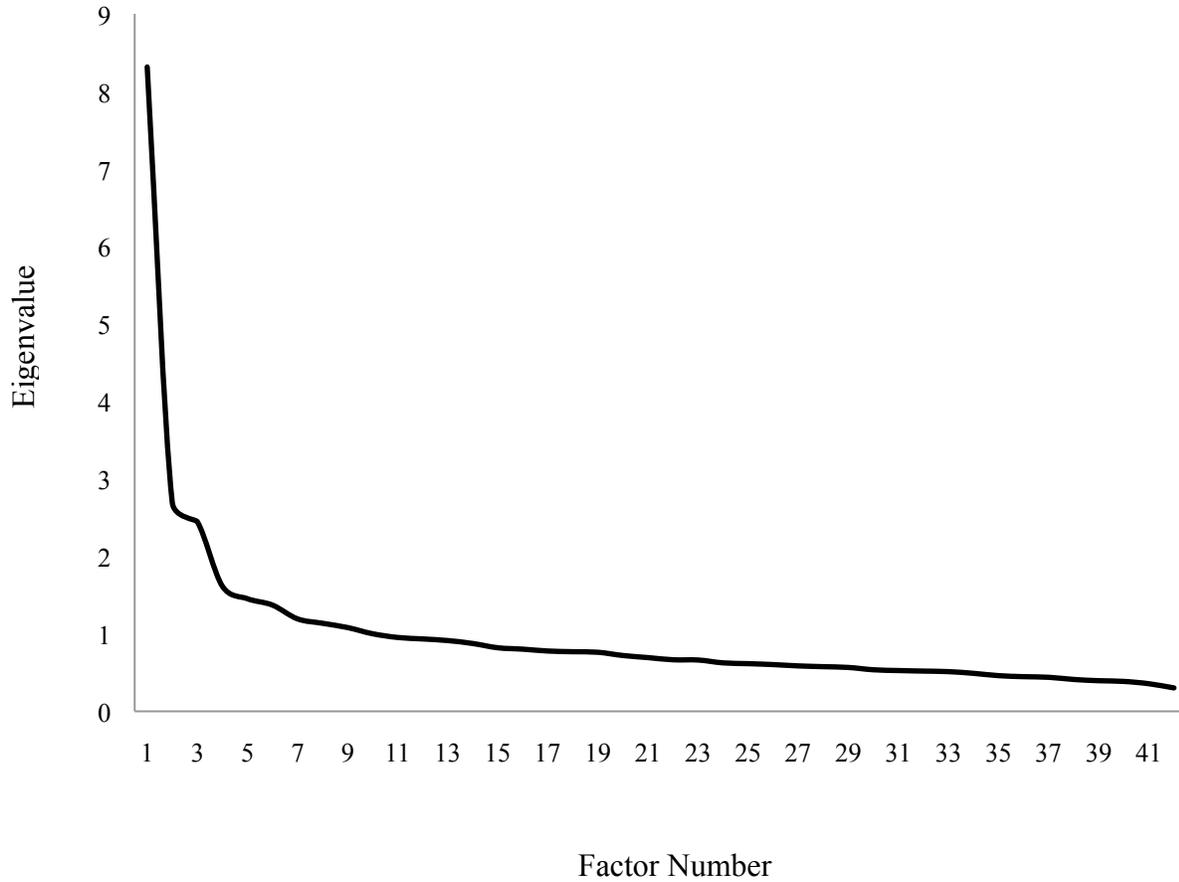


Figure 1. Exploratory factor analysis scree plot for the kindergarten reading instructional practices and activities.

Cronbach’s alpha was calculated for the reliability of the scale based on the items with loadings greater than .3 in the rotated factor matrix. Reliabilities greater than .70 are appropriate for social science research (Field, 2005). Factor 3 had a reliability of .71.

The factors’ scores were calculated using the Regression method. The factor score for the third factor associated with phonics and instruction in the sound-symbol relationship was included in the analysis of the predictors of LDR at third and fifth grade.

Table 5

Variables with Loadings Greater than Absolute Value of .3 on Factor 3 in the Factor Analysis

Study Variable	Variable Description	Rotated Factor Matrix
KMATCH	Match letters to sounds	.624
KRCGNZE	Alphabet and letter recognition	.597
KLERNLT	Work on letter names	.540
KPRACTL	Writing letters of the alphabet	.441
KPHONIC	Work on phonics	.439
KWRTNME	Writing own name	.388
KCONVNT	Conventions of print	.366
KRHYMNG	Rhyming words	.351
KNEWVOC	Discuss new or difficult vocabulary	.337
KDRCTNS	Following complex directions	.304

Dependent Variables

The outcome variable at third and fifth grade was dichotomous (LDR absent, LDR present). LDR was derived from the special education teacher questionnaire and the general education teacher questionnaire collected during the spring of the students' third and fifth grade years. The special education teacher survey was used to determine if the students' primary disability was a learning disability and if the students had an IEP goal in the area of reading. The presence of these factors resulted in the variable LDR coded as "1." Not having LDR was determined by both the absence of a special education teacher questionnaire and the general education teacher indicating that the student

did not receive special education or related services. Students with another disability or students with LD but no reading IEP goals were excluded from the analysis.

Demographic Information

A list of the demographic variables is provided in Table 6.

Early intervention. Kindergarten teachers answered questions from Part C of the questionnaire related to each student receipt of early intervention services (USDE NCES, 2006). The provision of early intervention services was determined by the kindergarten teacher positively indicating that a student participated in an individual tutoring program for reading, a pull-out small group program for reading, a Title I reading program, and/or a Title I English/language arts program. In the event of missing data, early intervention was coded based on the information available.

Gender. Data related to gender were collected during the kindergarten fall parent interview (USDE NCES, 2000). The ECLS-K staff collected missing data from the field management system.

Race/ethnicity. Student ethnicity was derived from the race-ethnicity composite variables (USDE NCES, 2000). Based on data from the parent interviews, race and ethnicity were coded: White, non-Hispanic; Black or African American, non-Hispanic; Hispanic, race specified; Hispanic, race not specified; Asian; Native Hawaiian or Pacific Islander; American Indian or Alaskan Native; or more than one race, non-Hispanic. Some categories were collapsed to protect confidentiality.

Socioeconomic status. Socioeconomic status is a derived composite score reported in the ECLS-K data set based on family information at the time of the fall and spring kindergarten parent interviews (USDE NCES, 2000). The three components of the composite variable are: household income level, total number of household members, and Census-defined thresholds of poverty. In the parent survey, 28.2% of the participants did not report household income. Hot deck imputation was used by the ECLS-K staff to fill in the missing variables. Individuals with missing data were matched

to those with similar characteristics. Then, a value for the missing data was randomly selected from the group of similar participants who did provide a response for that question (USDE NCES).

Location. This includes the area in which the school was located and the information was collected from the sampling frame. The categories were collapsed into three sections: large or midsize city, the urban fringe of large or midsize cities or a large town, or a small town or rural area.

Region. The four regions are based on Census information and include: Northeast, Midwest, South, and West.

Time in general education. For students identified with LDR, the percentage of time spent in the general education classroom is noted. The percentages reported are collapsed categories from the ECLS-K survey and the percentages are reversed to reflect the percentage of time in the general education classroom rather than the time outside of the general education classroom.

Table 6

Demographic Variables, Definitions, and Corresponding ECLS-K Variables

Study variable	Definition	ECLS-K variables
SGENDER	Student gender 0 – male, 1 – female	GENDER
RACEETH	Student race 0-White, 1-Black, 2-Hispanic, 3-Other	RACE
SPOVERTY	Poverty Status 0-below poverty threshold, 1-at or above poverty threshold	WKPOV_R
EARLYK	Early Intervention 0-received early intervention services, 1 – did not receive services	T2TTRRD T2SGRD T2TT1RD T2TT1ENG
GRADE3	Grade level in third grade collection wave. 2 nd - 4 th grades.	T5GLVL
GRADE5	Grade level in fifth grade collection wave. 3 rd - 6 th grades.	T6GLVL
LOCALE3	Location of school at 3 rd grade 1-large or midsize city, 2-large or midsize suburbs or large town, 3-small town or rural	R5LOCALE
LOCALE5	Location of school at 5 th grade 1-large or midsize city, 2-large or midsize suburbs or large town, 3-small town or rural	R6LOCALE

Table 6 continued

Study variable	Definition	ECLS-K variables
REGION3	Location of school at 3 rd grade 1-Northeast, 2-Midwest, 3-South, 4-West	R5REGION
REGION5	Location of school at 5 th grade 1-Northeast, 2-Midwest, 3-South, 4-West	R6REGION
SPEDTM3	Time spent in general education classroom 1->90%, 2-51-89%, 3- <49%	E5SPEDOT
SPEDTM5	Time spent in general education classroom 1->90%, 2-51-89%, 3-<49%	E6SPEDOT

Statistical Analysis

Weights

The ECLS-K data set utilized a nested sample design consisting of three stages: geographic areas, schools, and students (USDE NCES, 2006). As a result, clusters of students in the sample population are from the same kindergarten classroom. Assumptions about the independence of sample selection cannot be made because a simple random sample was not utilized. The purpose of this research was to focus on the individual student, rather than the geographic area or classroom cluster from where the students were selected, therefore adjustments for the potential clustering effect were made (Hahs-Vaughn, 2005). The ECLS-K study purposefully over selected Asian/Pacific Islander students. In addition, not all students were followed if they moved outside of the PSU and certain groups of children were followed at a higher rate than others (e.g. language minority students). Without the utilization of an analytic weight, the results would "be biased in favor of the groups that were over sampled" (Hahs-Vaughn, p. 228). Child-level longitudinal sample weights were used in the

analyses to compute estimates that could be applied to the population of students who attended kindergarten in the 1998-1999 school year. Replicate weights were utilized to adjust for the use of a nonrandom sample. Due to the large sample size and the application of analytic weight, without the application of the replicate weights, the standard errors would be underestimated. This would lead to Type II error, not rejecting a false null hypothesis (Hahs-Vaughn).

Analysis

The hypotheses were tested through logit analyses using AM Statistical Software (American Institutes for Research, 2003). AM Statistical Software was developed to account for the complex sampling techniques of large surveys such as the one in the ECLS-K. The paired jackknife method (JK2) was used to calculate the variance estimations with the replicate weights. The appropriate analytic weight was also applied to each analysis. Logit analyses were used.

Several steps were conducted to determine the significant kindergarten predictors of LDR. First, the independent variables were analyzed separately as predictors of LDR at third and again at fifth grade. Significant or nearly significant ($p < .25$) variables were included in the multivariable analysis (Hosmer & Lemeshow, 2000). The overall model significance was determined using the Adjusted Wald statistic, which accounts for the complex sampling design used in surveys (Roberts, Rao, & Kumar, 1987) such as the ECLS-K. Any nonsignificant variables in the multivariable analysis were removed and the analysis was rerun without the nonsignificant variable(s). The coefficients of the retained variables were compared to the variables' coefficients in the full model. A large change in the coefficient would indicate that the removed variable was confounding and should remain in the model (Hosmer & Lemeshow).

The odds ($\text{Exp}(B)$) were calculated by taking the antilogarithm of the coefficient or logit (Pampel, 2000) ($\text{odds} = \exp^B$). An odds of 1 indicates that there is no change in the dependent variable when the level of the independent variable changes. Odds less than 1 indicate a decrease in

the odds of the dependent variable. Odds greater than 1 indicate an increase in the odds (Pampel). By taking the distance from 1 and multiplying that by 100, it is possible to interpret the percentage change in odds for every one unit change in the independent variable:

$$\text{Percent change} = (e^B - 1) * 100.$$

This procedure reduces some of the difficulties with the interpretation of odds less than 1 (Pampel, 2000).

Confidence intervals of the odds were calculated to determine if the odds significantly differed from 1. The 95% confidence intervals were calculated from the coefficient and standard error. The formula used to calculate the 95% confidence interval was:

$$95\% \text{ CI} = \exp (B \pm 1.96SE)$$

The odds confidence intervals for the third and fifth grade predictors were compared to determine any significant differences in the predictors at different grade levels.

Odds and change in the odds per unit change in an independent variable are constants regardless of the value of the independent variable. Probabilities can be calculated for specific values of the independent variables (Pampel, 2000). The constant and coefficients were used in the equation:

$$\text{logit} = \text{Constant} + BX_1 + BX_2 + \dots + BX_i$$

Using the equation, the mean and other relevant values based on the standard deviation were used to calculate the logit (L) for a specific case. The logit was transformed into the probability for specific values of the independent variables (Pampel, 2000).

$$\text{Probability} = 1/(1+e^{-L})$$

Summary

The present research was an analysis of the K-5 wave of the ECLS-K study, collected by the U.S. Department of Education. Using the data collected from various sources over a period of six years, the relationship between the independent variables of age on the first day of kindergarten, early

social-academic behaviors, early reading skills, and early reading instruction in the sound-symbol relationship were examined as predictors of LDR at two time points. The goal of the analysis was to identify the early school factors that best predicted school-identification of a learning disability with IEP goals in reading.

CHAPTER 4 – RESULTS

The purpose of this study was to determine which kindergarten factors were predictive of identification of a learning disability with IEP goals in reading at third and fifth grades. The data from the ECLS-K allowed for a longitudinal descriptive analysis of early kindergarten factors with a large data set that included both students with LDR and nondisabled peers. In this study kindergarten age on the first day of school, social-academic behaviors, reading skills, and instruction in the sound-symbol relationship were examined.

The results from the logit analyses provided evidence of statistically significant predictors of LDR at two time points: third grade and fifth grade. The results of the significance tests for the third grade analyses are presented first, followed by the fifth grade analyses. To aid in the interpretation of the results, the odds and confidence intervals are provided. In order to better understand the relationship between the independent variables and LDR, the logit equations were used to derive the probability of LDR identification at specific values of the independent variables. For each data collection wave (third and fifth) the results are presented for all students in kindergarten when the study began and again with students who were in kindergarten for the first time in the 1998-1999 school year. The results of the first four hypotheses tests are summarized at the end of the third grade and again at the end of the fifth grade analyses. At the conclusion of the fifth grade section, the final hypothesis comparing the third grade and fifth grade results is discussed.

Third Grade

All Students

Table 7 provides the demographic information for the eligible students at the third grade data collection wave regardless of kindergarten retention status. Of the students in the sample, approximately 280 had a learning disability in reading and approximately 6,240 were not identified as having a disability. A total of 4.7% (weighted percentage) were identified with a learning disability in

reading. The majority of the students identified as LDR were male (72.2%). The race and ethnicity percentages of the two groups of students were similar. About half of the students with LDR received supplemental early intervention services in kindergarten, compared to less than a quarter of the students who did not have a school identified learning disability in reading at third grade.

Approximately 25% of the students with LDR were in second grade at the time of the third grade data collection wave, compared to less than 10% of the nondisabled students. In addition approximately 16% of the students identified with LDR had repeated kindergarten in the 1998-1999 school year.

Approximately 3% of students without a disability repeated kindergarten in 1998. Most students with LDR spent more than 50% of the day in general education classrooms.

Table 7

Demographic Information at Third Grade for All Students

	LDR Weighted Percentage	Nondisabled Weighted Percentage
Gender		
Male	72.2	49.0
Female	27.8	51.0
Race/Ethnicity		
White	64.1	64.1
Black	14.2	16.2
Hispanic	14.9	12.6
Other	6.8	6.7
Socioeconomic Status		
At or above poverty	72.1	79.1
Below poverty level	26.4	17.8
Early Intervention in K		
Yes	47.1	22.6
No	51.4	76.5
Geographic Region		
Northeast	20.7	18.2
Midwest	25.7	25.0
South	40.7	38.3
West	12.9	18.5

Table 7 continued

	LDR Weighted Percentage	Nondisabled Weighted Percentage
Location		
Large, mid-size city	24.7	25.3
Suburb, large town	36.7	40.7
Small town, rural	36.7	32.9
Grade		
2 nd grade	24.6	9.1
3 rd grade	75.4	90.7
4 th grade	0	0.2
Repeated Kindergarten		
Known repeater	16.2	2.7
Known 1 st time	76.1	91.5
Unknown	7.7	5.8
General Education		
More than 90%	21.2	
Between 50 & 89%	63.3	
Less than 49%	15.0	

Note. Percentages may not add to 100% due to rounding and/or missing data.

The weighted means and standard deviations for students with LDR, students without disabilities, and all the students at the third grade are shown in Table 8.

Table 8

Weighted Means and Standard Deviations of Independent Variables at Third Grade for All Students

Variable	LDR		Nondisabled		All Students	
	Mean	SD	Mean	SD	Mean	SD
Age on first day of school	67.20	5.62	65.11	4.13	65.21	4.23
Social-academic behavior rating	2.54	0.65	3.06	0.65	3.03	0.66
Reading t-score	40.67	6.72	50.51	9.59	50.05	9.70
Phonics regression score	0.08	0.64	0.04	0.80	0.04	0.79

The first logit analysis included all public school students in grades two through four at the third grade collection wave of the ECLS-K data. Individually, age at the start of kindergarten, teacher ratings of student social-academic behavior, and reading skills were significant ($p < .01$) predictors of LDR (Table 9). The frequency of instruction in the sound-symbol relationship was not a significant predictor of LDR and was not considered for the multivariable model ($p > .25$). When combined in a multivariable analysis, age at the start of kindergarten, social-academic behavior, and reading continued to be significant predictors ($p < .01$) of LDR at third grade (Table 10).

Table 9

Univariable Models for LDR at Third Grade for All Students

Variable	<i>B</i>	SE <i>B</i>	t	Exp(<i>B</i>)	95% CI	Wald	Sig
Age	0.11	0.02	5.30	1.12	1.07 - 1.16	28.04	.000
Behavior	-1.17	0.13	-8.83	0.31	0.24 - 0.40	77.95	.000
Reading	-0.13	0.01	-15.81	0.88	0.86 - 0.89	249.97	.000
Phonics	0.06	0.09	0.68	1.07	0.89 - 1.28	0.47	.50

Table 10

Multivariable Model for LDR at Third Grade for All Students

Variable	<i>B</i>	SE <i>B</i>	<i>t</i>	Sig.	Exp(<i>B</i>)	95% CI
Constant	-6.85	1.40	-4.91	.000		
Age	0.18	0.02	8.39	.000	1.20	1.15 - 1.25
Behavior	-0.74	0.16	-4.72	.000	0.48	0.35 - 0.65
Reading	-0.14	0.01	-13.88	.000	0.87	0.86 - 0.89

Adjusted Wald = 103.02, $p < .001$

In the multivariable model, when controlling for social-academic behavior and reading scores, the odds of being identified LDR at third grade increased by 20% for every one month increase in age. For every one point decrease in social-academic behavior ratings, the odds of LDR identification increased by 52% after controlling for reading and age at time of kindergarten entry. Controlling for the other factors, the odds of LDR identification at third grade increased by 13% for every one point decrease in early kindergarten reading scores.

In order to aid in the interpretation of the results, the probability of LDR identification was determined using the logit equation and relevant values of the independent variables.

$$\text{Logit} = -6.85 + 0.18(\text{AGE}) + -0.74(\text{BEHAVIOR}) + -0.14(\text{READING})$$

The logit for LDR identification for a case with average age, average social-academic behavior, and average reading score was calculated by substituting the mean score for each independent variable into the equation (Pampel, 2000) (see Table 8 for the total weighted sample means and standard deviations). Values one or two standard deviations above or below the mean were entered into the

logit equation and the log odds were transformed into a probability of LDR identification. The probability of LDR identification for average and extreme cases was determined.

The probabilities based on relevant values of independent variable are shown in Table 11. Average age, social-academic behaviors, and reading skills resulted in a probability of LDR identification at third grade of .02. This is less than the probability of LDR identification in the general population (probability of .04). For a case with an age that was one standard deviation above the mean, and social-academic behavior ratings and reading scores that were one standard deviation below the means, the probability of LDR identification was .19. When age, social-academic behavior, and reading are two standard deviations from their respective mean, the probability of LDR is .76. Below average reading had a greater impact on the probability of LDR than below average social-academic behavior. Average age (slightly less than five and a half years old) and average social-academic behavior, but low reading scores resulted in a probability of .06. Average age and average reading, but low social academic behavior only resulted in a probability of .03. However, low reading and low social-academic behavior together increased the probability of LDR identification at third grade, more than kindergarten reading scores alone. Even when values were one standard deviation from the means, the combination of average age at the start of kindergarten, low teacher ratings of social-academic behavior, and low reading scores in kindergarten resulted in a probability of .10. For students over the age of six in kindergarten (very high age) in combination with both low social-academic behavior and low reading, the probability of identification of LDR was .34.

Table 11

Probabilities of LDR Identification at Third Grade with Specific Values of the Independent Variables for All Students

Social Academic-Behavior	Average	Low	Very Low	Low	Average	Low	High
Reading Scores	Average	Low	Very Low	Average	Low	High	Low
Age							
Average	.02	.10	.40	.03	.06	.01	.04
High	.04	.19	.59	.06	.13	.02	.08
Very High	.08	.34	.76	.12	.24	.04	.16
Low	.01	.05	.24	.01	.03	.00	.02

Note. Average - mean score
 High - one standard deviation above the mean
 Very High - two standard deviations above the mean
 Low - one standard deviation below the mean
 Very low - two standard deviations below the mean

Students Who Were First-time Kindergarteners

The results of the initial analysis indicate that older students were more likely to be identified as having LDR. However, the sample includes both first time and repeating kindergarten students. Being older may be more related to retention rather than a variation within the ages of first time kindergarten students. A second analysis was conducted with only students whose parents reported that it was their child's first time in kindergarten. Students who repeated kindergarten and students who had missing data for this variable were excluded from this analysis.

The demographic information for the sample of the students in the third grade data collection wave who attended kindergarten for the first time in 1998 is presented in Table 12. Slightly less than four percent the students in kindergarten for the first time in the 1998-1999 school year were identified as LDR at third grade. Of the sample, 220 students were identified as LDR compared to 5,800 students without a school-identified disability (raw sample number rounded to the nearest ten to protect confidentiality). Similar to the full sample of students, the majority of the students identified as LDR were male (70.9%). Students with LDR and students not identified with a disability had similar percentages related to race and ethnicity and household poverty level. Less than half of the students with LDR and less than a quarter of the nondisabled students participated in a supplemental early intervention program in kindergarten. The majority of the students with LDR participated in general education classrooms at third grade for more than 50% of the day. The weighted means and standard deviations for the four kindergarten independent variables are shown in Table 13.

Table 12

Demographic Information at Third Grade for Students Who Were First-time Kindergartners

	LDR Weighted Percentage	Nondisabled Weighted Percentage
Gender		
Male	70.9	48.5
Female	29.1	51.5
Race/Ethnicity		
White	66.7	66.1
Black	11.4	15.4
Hispanic	14.5	12.1
Other	7.4	6.2
Socioeconomic Status		
At or above poverty	77.1	82.8
Below poverty level	22.9	17.2
Early Intervention in K		
Yes	44.7	21.9
No	53.4	77.6
Geographic Region		
Northeast	21.9	18.1
Midwest	26.3	25.3
South	39.0	38.6
West	12.8	18.0

Table 12 continued

	LDR Weighted Percentage	Nondisabled Weighted Percentage
Location		
Large, midsize city	25.9	24.7
Suburb, large town	35.9	41.0
Small town, rural	36.1	33.2
Grade		
2 nd grade	28.5	8.5
3 rd grade	71.5	91.3
4 th grade	0	0.2
Time in General		
Education		
More than 90%	24.5	
Between 50 & 89%	65.4	
Less than 49%	9.2	

Note. Percentages may not add to 100% due to rounding and/or missing data.

K = Kindergarten

Table 13

Weighted Means and Standard Deviations of Independent Variables at Third Grade for Students Who Were First-time Kindergarteners

Variable	LDR		No Disability		All Students	
	Mean	SD	Mean	SD	Mean	SD
Age in months	65.45	4.07	64.98	3.97	64.99	3.98
Fall K Social Academic Behavior	2.52	0.65	3.07	0.65	3.05	0.66
Fall K Reading t-score	39.79	6.19	50.63	9.48	50.21	9.60
Regression Phonics Instruction	0.01	0.69	0.04	0.80	0.04	0.79

Individually, social-academic behavior and reading were significant predictors of LDR ($p < .01$) (see Table 14). Age at the start of kindergarten was not a significant predictor, but had a p value of less than .25, indicating that it could be considered in a multivariable model (Hosmer & Lemeshow, 2000). It should be noted that the confidence interval for age indicates that, individually, the odds for LDR identification were not significantly different than 1 (no effect).

As shown in Table 15 in the multivariable model, age at time of kindergarten entry, social-academic behavior, and reading were significant predictors of LDR at third grade. Older students were more likely to be identified as LDR at the third grade collection wave. For every one month increase in age, the odds of LDR identification increased by 12%. Controlling for age and reading, for every one point decrease on the teacher rating of social-academic behavior, the odds of LDR identification increased by 50%. The odds of LDR identification increased by 13% for every one point decrease on the reading measure.

Table 14

Univariable Models for LDR at Third Grade for Students Who Were First-time Kindergartners

Variable	<i>B</i>	SE <i>B</i>	t	Exp(<i>B</i>)	95% CI	Wald	<i>p</i>
Age	0.03	0.02	1.43	1.03	0.99 - 1.07	2.055	.16
Behavior	-1.25	0.14	-9.19	0.29	0.22 - 0.38	84.40	.000
Reading	-0.15	0.01	-17.69	0.86	0.84 - 0.87	312.89	.000
Phonics	-0.04	0.01	-0.42	0.96	0.80 - 1.16	0.18	.68

Table 15

Multivariable Model for LDR at Third Grade for Students Who Were First-time Kindergartners

Variable	<i>B</i>	SE <i>B</i>	t	<i>p</i>	Exp(<i>B</i>)	95% CI
Constant	-2.17	1.42	-1.53	.13		
Age	0.11	0.02	4.82	.000	1.12	1.07 - 1.17
Behavior	-0.70	0.16	-4.36	.000	0.50	0.36 - 0.68
Reading	-0.15	0.01	-13.78	.000	0.87	0.85 - 0.88

Adjusted Wald = 89.53 ($p < .001$)

Again, in order to aid in the understanding of the relationship between the independent and dependent variables, the predicted probabilities for specific values of the independent variables based on the means and standard deviations (shown in Table 13) are presented in Table 16. The probabilities for first time kindergarten students are similar, but generally lower than the findings for students regardless of kindergarten retention status. When the independent variables were at their mean values, the probability of LDR identification was very low (.02). When the variables deviate one standard deviation (age one standard deviation higher, behavior and reading one standard

deviation lower), the probability of LDR identification increased to .14. However, when the scores deviated by two standard deviations from the mean, the probability of LDR identification at third grade for first time kindergarten students was .63.

Table 16

Probabilities of LDR Identification at Third Grade with Specific Values of the Independent Variables for Students Who Were First-time Kindergartners

Equation: $\text{Logit} = -2.17 + (0.12 * \text{AGE}) + (-0.70 * \text{SAB}) + (-0.15 * \text{READING})$

Social Academic Behavior	Average	Low	Very Low	Low	Average	Low	High
Reading Scores	Average	Low	Very Low	Average	Low	High	Low
Age							
Average	0.02	0.09	0.41	0.02	0.06	0.01	0.04
High	0.02	0.14	0.52	0.04	0.09	0.01	0.06
Very High	0.04	0.20	0.63	0.06	0.14	0.01	0.09
Low	0.01	0.06	0.30	0.02	0.04	0.00	0.03

Note. Average - mean score
 High - one standard deviation above the mean
 Very High - two standard deviations above the mean
 Low - one standard deviation below the mean
 Very low - two standard deviations below the mean

Summary of Hypotheses

The first four hypotheses, with respect to third grade identification of LDR, are reviewed here.

H₁: Students who were younger at the start of kindergarten were significantly more likely to be identified as Learning Disabled in Reading at the third grade.

These results do not support the hypothesis. Being older at the start of kindergarten, regardless of kindergarten retention status, was a significant predictor of LDR at third grade.

H₂: Students who received lower teacher ratings on a measure of social-academic behavior were significantly more likely to be identified as Learning Disabled in Reading at the third grade.

The results of these analyses support the hypothesis for all kindergarten students and for first time kindergarten students. Even after controlling for student age and reading skills at the start of kindergarten, students who received lower teacher ratings on a measure of social-academic behavior had a greater likelihood of being identified LDR at third grade than students with higher social-academic behavior ratings.

H₃: Students who earned lower scores on a measure of early reading skills were significantly more likely to be identified as Learning Disabled in Reading at the third grade.

The results of these analyses support the hypothesis for all kindergarten students and for first time kindergarten students. Students with lower fall kindergarten reading scores were more likely to be identified as LDR at third grade.

H₄: Students who reportedly received less reading instruction in sound-symbol relationship were significantly more likely to be identified Learning Disabled in Reading at the third grade.

These results do not support this hypothesis regardless of kindergarten retention status. Teachers' self-reported ratings of the frequency of instruction in the sound-symbol relationship in kindergarten were not significant predictors of LDR at third grade.

Fifth Grade

All Students

The procedure for the fifth grade sample was similar to the third grade analyses. Demographic information with the weighted percentages for each group is presented in Table 17. The sample includes approximately 310 students with LDR and 5,710 students without disabilities (weighted percentage of 5.8% identified as LDR). Approximately 45% of students identified as LDR at fifth grade were also receiving services for a learning disability with IEP goals in reading at third grade. Slightly more than 60% of students identified with LDR were male, compared to slightly less than 50% of the students without disabilities. The two groups had similar percentages in terms of race and ethnicity. There were more students with LDR at fifth grade from households below the poverty line (32.5%) than those without disabilities (18.1%). Approximately half of the students later identified as LDR received early intervention services in reading during kindergarten. Less than a quarter of the students who did not have an identified disability at fifth grade participated in early intervention in kindergarten. At the time of the fifth grade data collection wave, 77% of the students with LDR were in fifth grade, compared to 87% of the students without disabilities. An additional 13% of students identified as LDR had repeated kindergarten in the 1998-1999 school year. Most students with LDR were in general education classrooms for more than 50% of the school day. The weighted means and standard deviations for the four kindergarten independent variables are presented in Table 18.

Table 17

Demographic Information at Fifth Grade for All Students

	LDR Weighted Percentage	Nondisabled Weighted Percentage
Gender		
Male	62.9	48.7
Female	37.1	51.3
Race/Ethnicity		
White	56.9	60.8
Black	16.0	16.9
Hispanic	21.1	14.2
Other	5.9	7.6
Socioeconomic Status		
At or above poverty	63.8	79.2
Below poverty level	32.5	18.1
Early Intervention in K		
Yes	48.9	23.8
No	51.1	75.1
Geographic Region		
Northeast	21.2	17.2
Midwest	32.6	24.0
South	30.8	39.7
West	15.4	19.1

Table 17 continued

	LDR Weighted Percentage	Nondisabled Weighted Percentage
Location		
Large, midsize city	31.0	27.9
Suburb, large town	33.1	41.4
Small town, rural	28.7	29.2
Grade		
3 rd grade	2.7	0.4
4 th grade	27.8	12.3
5 th grade	69.5	86.9
6 th grade	0	0.5
Repeated K in 1998		
Known repeater	12.9	2.4
Known 1 st time	77.3	91.7
Missing	9.8	5.9
Time in General education		
More than 90%	32.1	
Between 50 & 89%	54.5	
Less than 49%	13.3	

Note. Percentages do not equal to 100% due to missing data and/or rounding

K = Kindergarten

Table 18

Weighted Means and Standard Deviations of Independent Variables at Fifth Grade for All Students

Variable	LDR		No Disability		All Students	
	Mean	SD	Mean	SD	Mean	SD
Age	66.62	5.09	65.21	4.10	65.29	4.18
Fall K Social Academic Behavior	2.62	0.66	3.04	0.65	3.01	0.66
Fall K Reading t-score	41.57	6.51	50.58	9.74	50.05	9.81
Regression Phonics Instruction	0.03	0.81	0.03	0.81	0.03	0.81

For all students, regardless of kindergarten retention history, age at the beginning of kindergarten, social-academic behavior, and reading scores were individually significant predictors of LDR. The frequency of reading instruction in the sound-symbol relationship was not a significant predictor of LDR at fifth grade (See Table 19 for results of individual hypothesis tests). The combination of age, social-academic behavior, and reading scores in the multivariable logit analysis resulted in a significant model (Wald = $p < .001$). All three variables continued to be significant (see Table 20). Older students were more likely to be identified with a learning disability in reading. For every one month increase in age, the odds of LDR identification increased by 14.7%. Students with lower teacher ratings of social-academic behavior in early kindergarten were more likely to be identified LDR at fifth grade. For every one point decrease in teacher ratings of student social-academic behavior, the odds of LDR identification increased by 48.8%. The odds of LDR identification increased by 11% for every one point decrease in reading, controlling for age and social-academic behaviors. The confidence intervals for the odds in the multivariable model are significantly different than one, indicating each variable is a significant predictor of LDR at fifth grade for all students.

Table 19

Univariable Models for LDR at Fifth Grade for All Students

Variable	<i>B</i>	SE <i>B</i>	t	Exp(<i>B</i>)	95% CI	Wald	Sig
Age	0.08	0.03	3.17	1.08	1.03 - 1.14	10.05	.002
Behavior	-0.93	0.16	-5.75	0.40	0.29 – 0.54	33.02	.000
Reading	-0.12	0.01	-10.88	0.89	0.87 - 0.91	118.35	.000
Phonics	0.01	0.10	0.05	1.01	0.82 - 1.23	0.002	.96

Table 20

Multivariable Model for LDR at Fifth Grade for All Students

Variable	<i>B</i>	SE <i>B</i>	t	Sig.	Exp(<i>B</i>)	95% CI
Constant	-5.24	1.75	-2.99	.004		
Age	0.14	0.03	4.88	.000	1.15	1.09 - 1.21
Behavior	-0.49	0.20	-2.52	.013	0.61	0.42 – 0.90
Reading	-0.11	0.01	-8.92	.000	0.89	0.87 - 0.92

Adjusted Wald = 40.71 ($p < .001$)

The probability of LDR identification at fifth grade (Table 21) for a case with average age, average social academic-behavior ratings, and average reading scores was small (.03). When the significant independent variables deviated from the mean by one standard deviation (age one standard deviation older and behavior and reading one standard deviation lower) the probability of LDR identification increased to .19. A case with scores two standard deviations from the mean for the independent variables results in a dramatic increase to a probability of .64. Similar to the third grade

predictions, low reading scores had a greater impact on the probability of LDR than low social-academic behavior ratings, regardless of the student age when starting the kindergarten school year.

Table 21

Probabilities of LDR Identification at Fifth Grade with Specific Values of the Independent Variables for All Students

Equation: $\text{Logit} = -5.42 + (0.14 * \text{Age}) + (-0.49 * \text{Behavior}) + (-0.11 * \text{Reading})$

Social-academic Behavior	Average	Low	Very Low	Low	Average	Low	High
Reading Scores	Average	Low	Very Low	Average	Low	High	Low
Age							
Average	.03	.12	.36	.04	.09	.12	.07
High	.05	.19	.50	.07	.15	.03	.11
Very High	.09	.30	.64	.12	.24	.04	.18
Low	.02	.07	.24	.02	.05	.01	.04

Note. Average - mean score
 High - one standard deviation above the mean
 Very High - two standard deviations above the mean
 Low - one standard deviation below the mean
 Very low - two standard deviations below the mean

Students Who Were First-time Kindergarteners

A second analysis was conducted that included only students who, according to the parent interview, were attending kindergarten for the first time in 1998. Students with a learning disability in reading at fifth grade consisted of 4.9% (weighted percentage) population. Forty-three percent were also identified LDR at the third grade data collection wave. More males than females were identified LDR (Table 22). A larger percentage of students with LDR came from households below poverty than students without a disability. The majority of students with LDR spent more than 50% of the school day in a general education setting. Table 23 presents the weighted means and standard deviations for the independent variables for students with LDR, students without disabilities, and for both groups.

Table 22

Demographic Information at Fifth Grade for Students Who Were First-time Kindergartners

	LDR Weighted Percentage	Nondisabled Weighted Percentage
Gender		
Male	61.6	48.3
Female	38.4	51.7
Race/Ethnicity		
White	60.8	62.4
Black	12.2	16.4
Hispanic	21.7	13.9
Other	5.3	7.1
Socioeconomic Status		
At or above poverty	69.4	82.3
Below poverty level	30.6	17.7
Early Intervention		
Yes	47.3	22.7
No	52.7	76.3
Geographic Region		
Northeast	25.6	17.1
Midwest	34.5	24.3
South	28.1	40.1
West	11.7	18.4

Table 22 continued

	LDR Weighted Percentage	Nondisabled Weighted Percentage
Location		
Large, midsize city	30.7	27.8
Suburb, large town	34.7	41.8
Small town, rural	30.7	29.0
Grade		
3 rd grade	2.1	0.4
4 th grade	28.7	12.2
5 th grade	69.3	87.0
6 th grade	0	0.5
Time in General education		
More than 90%	33.1	
Between 50 & 89%	54.0	
Less than 49%	12.8	

Note. Percentages may not add up to 100% due to rounding and/or missing data.

K = Kindergarten

Table 23

Weighted Means and Standard Deviations of Independent Variables at Fifth Grade for Students Who Were First-time Kindergartners

Variable	LDR		No Disability		All Students	
	Mean	SD	Mean	SD	Mean	SD
Age in months	65.19	4.24	65.08	3.97	65.09	3.98
Fall K Social Academic Behavior	2.63	0.66	3.05	0.65	3.03	0.66
Fall K Reading t-score	40.70	6.07	50.62	9.60	50.14	9.70
Regression Phonics Instruction	-.03	0.86	0.03	0.81	0.03	0.81

Social-academic behavior and reading were significant predictors of LDR in the univariable analyses (Table 24). Age on the first day of school and the frequency of reading instruction in the sound-symbol relationship were not significant and had p -values greater than .25. When behavior and reading were included in a multivariable analysis, the Wald statistic for the overall model was significant, but reading was the only significant predictor. Behavior was not significant in the multivariable analysis that also included reading (Table 25). In addition, the confidence interval indicated that the odds for social-academic behaviors were not significantly different than one. A comparison of the reading coefficients of the multivariable model and univariable model for reading (Table 26) shows very little change in the reading coefficient. This pattern indicates that it is appropriate to remove social-academic behavior from the final model. For every one point decrease in kindergarten reading score, the odds of being identified with LDR at fifth grade, increased by 12%. The odds based only on kindergarten reading scores were similar for students who were in kindergarten for the first time and for all students in kindergarten in the 1998-1999 school year.

Table 24

Univariable Models for LDR at Fifth Grade for Students Who Were First-time Kindergarteners

Variable	<i>B</i>	SE	<i>t</i>	Exp(<i>B</i>)	95% CI	Wald	<i>p</i>
Age	0.01	0.03	0.27	1.01	0.96 - 1.06	0.07	.785
Behavior	-0.94	0.17	-5.41	0.39	0.28 - 0.55	29.26	.000
Reading	-0.13	0.01	-10.96	0.88	0.86 - 0.90	120.01	.000
Phonics	-0.08	0.11	-0.69	0.93	0.75 - 1.15	0.48	.489

Table 25

Multivariable Model for LDR at Fifth Grade for Students Who Were First-time Kindergarteners

Variable	B	SE B	<i>t</i>	<i>p</i>	Exp(B)	95% CI EXP(B)
Constant	3.47	0.59	5.89	.000		
Behavior	-0.30	0.19	-1.58	.12	0.74	0.51 - 1.08
Reading	-0.12	0.01	-8.81	.000	0.88	0.86 - 0.91

Adjusted Wald = 60.97 ($p < .001$)

Table 26

Reading Model for LDR at Fifth Grade for Students Who Were First-time Kindergarteners

Variable	B	SE B	<i>t</i>	<i>p</i>	Exp(B)	95% CI EXP(B)
Constant	3.06	0.55	5.59	.000		
Reading	-0.13	0.01	-10.96	.000	0.88	0.86 - 0.90

Adjusted Wald = 120.01 ($p < .001$)

Table 27 displays the probability of LDR identification at fifth grade when only considering the kindergarten reading score. For a case with the mean weighted reading score, the probability of LDR identification was lower than would be expected knowing the general population rate of LDR. When the reading score was one standard deviation below the mean score, the probability of LDR increased to .09.

Table 27

Probabilities of LDR Identification at Fifth Grade Based on Specific Reading Scores for Students Who Were First-time Kindergartners

	High	Average	Low	Very low
Probability	.01	.03	.09	.26

Note. Average - mean score
 High - one standard deviation above the mean
 Low - one standard deviation below the mean
 Very low - two standard deviations below the mean

For comparison, the univariable analysis for social-academic behaviors is presented in Table 28 and the probabilities based on the social-academic behavior rating scores are presented in Table 29. The probability of LDR identification based on a reading score two standard deviations below the mean (.26) was twice the probability of LDR identification based on a social-academic behavior rating two standard deviations below the mean (.13).

Table 28

Social-academic Behavior Model at Fifth Grade for Students Who Were First-time Kindergarteners

Variable	B	SE B	<i>t</i>	<i>p</i>	Exp(B)	95% CI EXP(B)
Constant	-0.30	0.47	-0.64	.525		
Behavior	-0.94	0.17	-5.41	.000	0.39	0.28 - 0.55

Adjusted Wald = 29.26 ($p < .001$)

Table 29

Probabilities of LDR Identification based on Specific Social-academic Behavior Scores at Fifth Grade for Students Who Were First-time Kindergartners

	Above	Average	Low	Very low
Probability	.02	.04	.07	.13

Note. Average - mean score

High - one standard deviation above the mean

Low - one standard deviation below the mean

Very low - two standard deviations below the mean

Summary of Hypotheses

At fifth grade, when considering all students who were in kindergarten at the start of the study, the combination of age, social-academic behavior, and reading scores were significant predictors of LDR. When only considering students who were first-time kindergarteners in the fall of 1998, only reading was a significant predictor of LDR in the multivariable model. The specific hypotheses are discussed below.

H₁: Students who were younger at the start of kindergarten were significantly more likely to be identified as Learning Disabled in Reading at fifth grade.

The results do not support the hypothesis; an opposite trend was found. For all kindergarten students, being older at the start kindergarten was a significant predictor of LDR at fifth grade. When only considering first time kindergarten students, age was not a significant predictor of LDR.

H₂: Students who received lower teacher ratings on a measure of social-academic behaviors were significantly more likely to be identified as Learning Disabled in Reading at fifth grade.

The results of this analysis partially support the hypothesis. In the analysis of all kindergarten students, social-academic behavior was a significant predictor of LDR individually and in combination with age and reading. However, in the analysis that only included students who were first time kindergarteners during the 1998-1999 school year, social-academic behavior was not a significant predictor of LDR when the analysis also included kindergarten reading scores.

H₃: Students who earned lower scores on a measure of early reading skills were significantly more likely to be identified as Learning Disabled in Reading at fifth grade.

The results support this hypothesis. Students with lower fall kindergarten reading scores were more likely to be identified as LDR at fifth grade.

H₄: Students who reportedly received less reading instruction in sound-symbol relationship were significantly more likely to be identified Learning Disabled in Reading at fifth grade.

The results of this analysis do not support this hypothesis, regardless of kindergarten retention status. The frequency of instruction in the sound-symbol relationship in kindergarten was not a significant predictor of LDR at fifth grade.

Comparison of Third and Fifth Grades

H₅: The kindergarten factors of (a) age at the start of kindergarten, (b) social-academic behaviors, (c) early reading skills, and (d) reading instruction in the sound-symbol relationship were significantly more likely to predict which students would be identified as Learning Disabled in

Reading in the third grade compared to the students identified as Learning Disabled in Reading in fifth grade.

The results of this study when including all kindergarten students in the 1998-1999 school year, regardless of retention status, do not support this hypothesis. The confidence intervals for the independent variables are overlapping at third and fifth grades. This pattern indicates that there were not significant differences in the predictive ability of these factors at third and fifth grades. When comparing the odds with a sample of students who were in kindergarten for the first time at the start of the study, the reading odds were similar at both time points. Age at the start and kindergarten were not significant predictors of LDR at fifth grade, and social-academic behavior was not a significant predictor when considering reading scores for students who were first-time kindergartners.

Phonics Instruction

The frequency of phonics-related instruction was not a significant predictor of LDR at third or fifth grade. A closer examination of the reading instruction revealed that teachers reported very similar frequencies of phonics related instruction. For example, more than 80% of the unweighted sample of students whose teacher completed the survey participated in daily instruction in letter-sound matching, letter recognition, letter names, and phonics. The lack of variability in scores suggests that kindergarten teachers reported similar patterns of instruction in the sound-symbol relationship. The frequency of this type of instruction did not predict later identification of LDR. However, frequency of instruction is only one way to quantify instruction. The quality and intensity of that instruction may be related to LDR identification and these factors were not examined.

Summary

Overall, students who were older on their first day of kindergarten, received lower teaching ratings of their social-academic behaviors, and had lower reading test scores were more likely to be identified as LDR at third and fifth grades. When including only students who had attended

kindergarten for the first time in fall of 1998, age, social-academic behavior and reading were significant at third grade, but only reading remained a significant predictor at fifth grade.

CHAPTER 5 – DISCUSSION

The purpose of this study was to investigate potential predictors of a learning disability with IEP goals in reading at third and fifth grades. The kindergarten through fifth grade data set from the ECLS-K was used to investigate how each of the following factors predicted LDR identification: (1) age at the start of kindergarten, (2) teacher ratings of student social-academic behavior, (3) early reading scores, and (4) frequency of reading instruction in the sound-symbol relationship in kindergarten. This study contributes to the understanding of learning disabilities because it combines factors that are individually related to predicting LD identification into a single analysis. In addition, outcomes in mid and late elementary school were considered, rather than only the short-term relationship with kindergarten predictors.

A summary of the results will be presented, followed by a comparison of the study's findings to the findings of previous literature in the field. Then, the implications of the study related to early intervention and LD identification will be considered. In light of the present study's findings, areas for additional research are explored. Limitations inherent to the analysis of a large longitudinal data set and specific limitations of the present study are discussed.

When including all kindergarten students from the 1998-1999 school year who attended public schools in the third or fifth grades the significant predictors were age at the start of kindergarten, fall teacher ratings of students' social-academic behaviors, and scores from the fall reading assessment. When including only first-time kindergarten students, age, social-academic behavior, and reading were significant predictors of LDR at third grade. At fifth grade, social-academic behaviors and reading scores were independently significant predictors. The only significant factor in the multivariable model was reading. The odds of LDR identification based on age, social-academic behavior, and reading were similar at both third and fifth grades when including

all students in the analysis. The frequency of reading instruction in the sound-symbol relationship in kindergarten was not a significant predictor of LDR at third or fifth grades.

Predictors of a Learning Disability in Reading

Age

The results of previous research examining the relationship between age in kindergarten and student outcomes vary. Younger students had lower reading achievement scores (Fleischman, 2007; Morrison et al., 1997); however, these achievement differences did not consistently persist into later grades (Shepard & Smith, 1986; Yesil-Dagli, 2006). Factors such as quality of child-care (NICHD, 2007), socio-economic status (McCoach et al., 2006), or instruction (Morrison, et al., 1997) were more related to reading achievement than age. Although age was not considered to be a relevant influence on achievement (Scarborough, 1998; Shepard & Smith), even a small difference in achievement may be related to the identification of a learning disability. Student age did relate to LD identification in some studies. Younger students in elementary and middle school were identified with a learning disability more often than would be expected due to chance (Maddux, 1980; Martin et al., 2004). Other studies (Tarnowski et al., 1990) found that although younger students were more likely to be referred for a learning disability evaluation, younger students were not more likely to be identified as LD compared to other age groups of students. Based on the research, it was expected that younger students would be more likely to be identified as LDR at third and fifth grades.

The results did not support the hypothesis that younger students in kindergarten would be more likely to be identified as LDR at third grade or at fifth grade. The opposite was found. Older kindergarteners were more likely to be identified LDR at third and fifth grades. Three factors related to age are considered in light of these findings: kindergarten retention, kindergarten red-shirting, and varying state age requirements for kindergarten entry.

The ECLS-K data set included both first-time and repeating kindergarten students. A student repeating kindergarten would generally be a year older than his/her classmates. Being older in kindergarten may be related to having been retained. Grade retention is often used as an intervention for students with low achievement before they are identified with a learning disability (McLeskey & Grizzle, 1992). Students identified with a learning disability had higher rates of retention than the national average (Barnett, Clarizio, & Payette, 1996). In addition, students who were at-risk for academic difficulty and who were retained had lower levels of achievement compared to students with similar academic difficulties who were not retained in kindergarten (Hong & Raudenbush, 2005). In the present study, a second analysis was conducted at both the third and fifth grade levels with only the students who were known to be first-time kindergarten students. Being older in kindergarten was a significant predictor of a learning disability at third grade in the multivariable analysis.

Voluntarily delaying kindergarten (“red-shirting”) may be a contributing factor related to the age results at third grade. Being young in kindergarten is often viewed as a risk factor for later school difficulties (Graue, Kroeger, & Brown, 2003). Parents and teachers express concern that younger or socially immature students need more time before they can meet the attention and academic demands of school (Graue & DiPerna, 2000). However, just providing additional time does not ensure a more positive outcome. Students who had been retained in kindergarten, or who were delayed in entering kindergarten were more likely to receive special education services (May, Nundeft, & Brent, 1995). May et al. did not provide an analysis of the relationship between red-shirting and LD identification, which complicates a comparison of those results to this study. Repeating or delaying kindergarten in the attempt to provide students with time to mature may be viewed as an initial intervention. However, if a student continued to experience academic difficulty, more intensive services, such as special education, might be provided. The student might require LD services in reading regardless of

kindergarten interventions. Further research is needed examining parental choice to delay kindergarten entry and LDR. See Malone et al. (2006) for a discussion of achievement differences and kindergarten retention and redshirting using the data from the ECLS-K.

Finally, age differences may be related to differences in state regulations and variability present in the ECLS-K sample. Older students with LDR may reside in states with higher rates of LD identification. Unlike the other studies examining the relationship between age in kindergarten and LD identification that included students from a single state or district, there is not a single national kindergarten age requirement (see Table 1). Variability in age may be more related to state definitions or procedures for learning disability identification than to actual age differences. States that have early birth date requirements (and therefore older kindergarteners) may have higher rates of LD identification overall.

Teachers and parents often express concern about a student not being mature enough or old enough to meet the academic and behavioral demands of school (Graue et al., 2003; May et al., 1995); however, it is not just younger children who experience academic and behavioral difficulty. Providing a student with more time before beginning school or in early elementary school does not eliminate the possibility of later academic difficulty. More research is needed to address the possible confounding reasons for older students being more likely to identified LDR.

Social-academic Behavior

Early elementary school social-academic behaviors have a significant relationship with later elementary school reading achievement (Chard et al., 2008; Duncan et al., 2007; McClelland et al., 2006). Students with learning disabilities and students who demonstrate resistance to classroom interventions often exhibited difficulties with classroom behavior such as attending to task, working independently, and motivation (Al Otaiba & Fuchs, 2002; McKinney et al., 1982; Nelson et al., 2003; Pintrich et al., 1994; Siderdis et al., 2006). Previous research that investigated the relationship

between social-academic behaviors and learning disabilities focused on students who were already identified, recently identified, or at-risk for LD identification rather than the longitudinal relationship between early deficits in social-academic behavior and LD identification.

The present study provides evidence of a significant longitudinal relationship between early social-academic behaviors and LD identification. Students with lower teacher ratings in kindergarten were more likely to be identified as LDR at third and at fifth grade when considering all kindergarten students and first time kindergartners at third grade. At fifth grade, social-academic behaviors of first-time kindergartners were only individually predictive of LDR, but not when included with reading scores. As students progressed through school, early social-academic behaviors had less of a relationship with LDR.

Reading

Consistent with previous research on reading achievement and learning disabilities (Felton, 1992; Hammill, 2004; Savage & Frederickson, 2006; Scarborough, 1998; Torgesen et al., 1996), early reading skills were significant and consistent predictors of LDR at both time points. This research provides additional support to the relatively few studies that have examined the relationship between kindergarten reading skills and late elementary school reading difficulties (i.e. Lipka et al., 2006). Students with lower reading skills were more likely to be identified as having a learning disability in reading than students with higher reading skills. In comparison to much of the research on predictors of low reading achievement and reading difficulty that examined specific reading skills (i.e. Bishop & League, 2006; Chard et al., 2008; Felton; Savage & Frederickson), this study used a composite reading measure comprised of questions related to letter identification, sound awareness, and sight word reading skills. A composite reading score in kindergarten is predictive of later reading achievement (Duncan et al., 2007), and is also a significant predictor of reading difficulty as manifested by a learning disability in reading. Using a composite reading score, rather than specific

individual skills, emphasizes that reading is a combination of skills, rather than just a single skill or component.

Reading Instruction

In this study, kindergarten reading instruction most related to teaching the sound-symbol relationship was not a significant predictor of LDR identification at third or fifth grades. A closer examination of the frequency of the instruction reveals little variability among teachers' reports of instruction in phonics, letter identification or similar instructional practices. Any small difference in the amount of sound-symbol relationship instruction was not related to different student outcomes. Similar to the conclusions of Al Otaiba et al. (2008), once a certain amount of phonics-related instruction is provided, any variability in instruction may not make an impact on student outcomes. This study's results also support the findings of other studies using the ECLS-K data. Matthews (2007) concluded that the frequency of kindergarten reading instruction practices as self-reported by teachers was not related to the reading achievement of students identified with learning disabilities. In addition, the analysis by Xue & Meisles (2004) did not find a relationship between student reading growth and phonics instruction in kindergarten.

Reading instruction can vary in type, intensity, and effectiveness (Snow et al., 1998). This study only examined the frequency of various types of instruction. Connor, Morrison, and Katch (2004) found that the interaction of the method of instruction and students' skills was related to achievement. For example, students who had limited vocabularies had different depending on if the instruction was teacher-directed or child-directed. One of the limitations of the present study is that it does not provide detailed information about the instructional practices in the classroom.

Implications for Early Intervention

The results of this study have implications related to early intervention. Early intervention programs can have a positive impact on student outcomes (Torgesen, 2002); however, identifying the

students most in need of these services is often challenging (McCardle et al., 2001). No Child Left Behind (2001) includes federal funding for effective reading programs through Reading First. However, early academic intervention programs are often not implemented for a long enough period of time to be effective for the most resistant learners (Fletcher et al., 2007) and general education teachers are not adequately prepared to provide explicit and systematic reading instruction to the students who need it most (Mather, Bos, and Babur, 2001). In this study, students who had lower reading scores in kindergarten were more likely to later receive special education services for a learning disability in reading. Timely, intensive reading intervention is needed, but reading intervention alone may not be sufficient.

The results of this research add to the evidence of a relationship between behavior and academic outcomes. Student social-academic behaviors are related to reading achievement (Duncan et al., 2007), intervention effectiveness (Nelson et al., 2003), and LDR identification. Recent legislation (NCLB, 2001) has emphasized the need for intensive, research-based early reading instruction and interventions. Research-based instruction and intervention related to classroom behaviors should also be considered. Behavioral interventions, such as self-monitoring, are effective for students in a variety of settings and grades (Webber, Scheuermann, McCall, & Coleman, 1993) and have been incorporated into response to intervention programs (Fairbanks, Sugai, Guardino, & Lathrop, 2007).

In this study less than 50% of the students who were later identified as having a learning disability at either the third or fifth grade received early supplemental reading intervention in kindergarten. Although students with learning disabilities are often the students most resistant to intensive reading interventions (Speece, Case, & Molloy, 2003; Vaughn, Linan-Thompson, & Hickman, 2003) little research has been done combining intensive reading and behavioral interventions for students at-risk for academic difficulty.

Implications for Learning Disability Identification

Students who have been identified as having a learning disability have been shown to demonstrate difficulty in other areas in addition to academics. Attending to classroom tasks, completing assignments, and working independently are often difficult for students with LD (McKinney & Feagans, 1983). In elementary school, students with LD who continue to demonstrate deficits in classroom behaviors tended to remain in special education, while those students who demonstrated improvement in classroom behavior were more likely to exit special education programs (McKinney, Osborne, & Schulte, 1993). This study showed that even as early as kindergarten, difficulty working independently, and being organized in class were related to an increased probability of later identification of LDR. Not all students with LDR demonstrated social-academic behavior deficits in kindergarten; however, as a group, it is important to consider that students with LDR may have a history of difficulty with the behavior that is necessary for participating and learning in the classroom.

Almost 20 years ago, a meta-analysis of the literature on classroom behavior, including on-task behavior and distractibility, revealed significant differences on those measures between students without disabilities and students with LD (Bender and Smith, 1990). The authors of the study proposed that behavior assessments should be part of the learning disability identification procedures. The most recent definition of a learning disability does not include a component related to social skills or classroom behavior; as a result, students with LD are less likely to be assessed in or receive intervention in these areas (Bryan, Burstein, & Ergul, 2004). Few studies examining students' response to reading interventions have incorporated formal measures of behavior or addressed the role that student behavior has on the effectiveness of an intervention in a meaningful way (Al Otaiba & Fuchs, 2002; Nelson et al., 2003). Including measures of classroom attention, organization, on-task

behavior, and motivation may aid in the identification of students with learning disabilities and provide information related to a needed area for intervention.

Future Research

Comparing various kindergarten intervention programs for students with low social-academic behavior and reading skills would provide additional insight into the relationship with early student factors and later identification of a learning disability. For example, at-risk students would be assigned to one of four intervention programs: reading only, social-academic behavior only, a combination of reading and behavior, or another intervention program that can serve as a control (i.e. math). Student progress during the intervention program should be monitored, as well as follow-up surveys throughout elementary school to examine any long-term impact of the early intervention program. Foorman et al. (1997) implemented a reading intervention comparing the effectiveness of reading programs. Including effective behavioral interventions could be used to explore the relationship of behavior and later outcomes, especially if the study is extended beyond the first two or three years of elementary school. Presently, few studies systematically investigate the behavior of students in early intervention programs (Al Otaiba & Fuchs, 2002; Nelson et al., 2003). Additional research should be conducted to investigate the relationship between social-academic behaviors and student outcomes.

There has been substantial debate in the field of special education about the accuracy and appropriateness of learning disability identification and how LD differs from general low achievement (Fuchs et al, 2001; Kavale & Forness, 2000). It would also be beneficial to consider if the kindergarten factors that are predictive of LDR are also predictive of below average reading skills in general (i.e. reading below the 25th percentile in third and fifth grades). Although it is important to consider the student characteristics of those who are later identified as having a learning disability, students with general low achievement in reading are also at-risk for continued reading difficulty.

Understanding the predictors of LDR and low achievement can help to determine the types of early intervention programs that may be beneficial for students at-risk for later reading difficulty. In addition, it may highlight the differences between students who are identified as LD and those who are not identified LD, but demonstrate reading difficulty.

This study utilized a composite reading score based on letter identification, sound awareness, and sight word knowledge. Although the use of a composite score allows for a more robust measure of reading skills, there is limited information available on which specific skills are most predictive of LDR. Including other measures, such as concepts about print, rapid automatic naming, or writing skills in conjunction with letter identification, phonemic awareness, and sight word recognition can provide additional insight into the reading skills that are most predictive of LDR. However, reading is a complex process. Considering individual component skills only may over-simplify and misrepresent the relationship between early reading difficulties and later LD identification. Regardless, future studies should include other reading skills that have been shown to be related to later reading difficulty (Bishop, 2003; Hammill, 2004) and consider other time points for assessment, such as first grade (Adams, 1990).

Although the frequency with which phonics-related instruction occurred in the kindergarten classroom alone was not a significant predictor of LDR at third and fifth grades, discounting a relationship between kindergarten instruction and LD identification would be premature. Reading programs with direct instruction in the sound-symbol relationship and structured opportunities for student interactions have improved the achievement of students with reading difficulty (Foorman et al., 1998; Kamps et al., 2004). As a result, it is essential to continue to investigate the long-term relationship between early instruction and student outcomes. Classroom observations should be used to determine if teacher-directed or student-directed instruction is a better indication of the relationship of instruction and LDR. Instead of a one-time assessment, multiple observations would also allow for

examination of any changes in instructional practices over the course of the year (Connor et al., 2004). Classroom observations, rather than a teacher survey, would allow for a measure of teacher enthusiasm and student-teacher interactions, which can be related to student reading achievement (Adams, 1990). Quality of teacher instruction, although often missing from research on reading instruction and interventions (Al Otaiba & Fuchs, 2002), is also an important component to consider. For example, Pianta, La Paro, Payne, Cox, & Bradley (2002) used the Classroom Observation System for Kindergarten which has a time-sampling procedure and rating scale to examine a variety of kindergarten classroom features including classroom management, instructional activities, and student-teacher interactions. Higher quality instruction was related to more appropriate classroom behaviors and more conversations between teachers and students regarding instruction. Additional research on the relationship of instruction and LDR should include a robust, observational measure of classroom instructional practices.

The findings of this study support the inclusion of additional factors that predict LDR identification. Considering multiple reading skills, either individually or in a composite score, along with student classroom behavior and the possible reasons for student age differences in kindergarten will be important to consider in future research.

Limitations of Study

There are several limitations inherent to an analysis of a large secondary data in general and other limitations that are specific to this study that impact the interpretation of results.

Large, longitudinal studies typically include missing data and sample attrition. The initial ECLS-K sample included over 21,000 kindergarten students; however, by fifth grade, the number of students remaining in the study was much less. Although the use of the weights in the analysis allowed for the analyses of students in later grades to be representative of the kindergarten students of the 1998-1999 school year, students with disabilities may have left the study at an unequal rate.

Students with a learning disability with specific characteristics may not be included in the analyses presented here. In addition, not all individuals in the study sample had a complete data set. This is especially so if a student was attending kindergarten for the second time during the 1998-1999 school year (see Tables 7 and 17). Information used in this analysis regarding kindergarten retention was obtained from the parent interview. Only 85.3% of parents completed the fall kindergarten interview (USDE NCES, 2000). Since students with LD are often the students who are retained (Barnett et al., 1996), it is an important variable to consider when determining student age in kindergarten.

The type of reading instruction received in kindergarten was dependent upon teachers' self-report of how frequently the students engaged in specific reading activities and instructional practices. While this provides some insight into the classroom practices, there are several limitations. First, self-report of this nature provides no information on the intensity or instructional modality. Second, it is often the quality of the reading instruction that is an indicator of student performance, rather than the frequency with which it is said to occur (Torgesen, 1999). Little information on intervention or instructional efficacy is a noted limitation of much research (Al Otaiba & Fuchs, 2002).

A noted criticism of teacher ratings of student behavior is that such assessments do not allow for an investigation of the intensity or the context in which the behavior occurs (McKinney et al., 1982). In this study, only the role of classroom social-academic behaviors (attention, independent work habits) was included in the analysis rather than a more robust measure of behavior that includes a wider variety of factors. Other factors, such as peer interactions (Nowicki, 2003) or social skills (Swanson & Malone, 1992) were not included in this analysis. In addition, only a small part of the larger SSRS was used by the ECLS-K study. A broader measure may lead to a better understanding of the relationship between early social-academic behaviors and LD.

The dependent variable (LDR or non-disabled) was derived from information from two sources: general education teacher report of special education services and special education report of

disability classification and IEP goal areas. The two teachers did not necessarily complete the surveys at the same time, which may explain some of the disagreement regarding special education participation. If the general education teacher stated that a student had a disability, but a special education teacher did not complete a survey, that case was excluded from the analysis. Students with LD who had IEP goals in reading may have been inadvertently excluded. Disability information was also available from the parent survey and the school office. However, there was not consistent agreement among these four sources regarding disability identification (IES, 2008). Although efforts were made to include as many public school students in this analysis as possible, there may be missing students or misclassified students, depending on when in the school year the survey was completed or if a special education survey was available. Using the disability classifications and IEP goals at one time point, such as the records corresponding with the data collected federal head count, would eliminate confusion and ensure that all students were recorded as having or not having a disability.

It must be noted that the results of this study cannot be used to infer causation between kindergarten factors and school-identified learning disabilities. Select factors from one grade (kindergarten) were observed to have a statistical relationship with third and fifth grade outcomes of LDR identification. Other factors could influence not only the identification of LDR, but also the kindergarten variables that were included in the present study.

Conclusion

The purpose of this study was to examine the early kindergarten predictors of a learning disability in reading at third and fifth grade. The logit analyses using the kindergarten through fifth grade data from the Early Childhood Longitudinal Study-Kindergarten cohort revealed that age in kindergarten, social-academic behaviors, and reading skills were predictive of LDR. Even in light of the discussed limitations, the results of this study indicate that older students with lower social-

academic behaviors and lower reading scores in kindergarten were more likely to be identified as LDR at both third and fifth grades. Being significantly older in kindergarten (two standard deviations above average), having significantly lower teacher ratings of social-academic behaviors (two standard deviations below average) and significantly lower reading scores (two standard deviations below the average *t*-score) resulted in the probability of LDR identification of .76 at third grade and .64 at fifth grade when including all kindergarten students. In light of these findings, early intervention programs and learning disability identification procedures need to consider more than reading skills. Student age and retention history as well as social-academic behaviors should be considered.

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