PREDICTORS OF READING GROWTH FOR STRUGGLING READERS WITH DISABILITIES

By

Larissa Anne Morlock

A DISSERTATION

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

DOCTOR OF PHILOSOPHY

School Psychology

2011

ABSTRACT

PREDICTORS OF READING GROWTH FOR STRUGGLING
READERS WITH DISABILITIES

By

Larissa Anne Morlock

In recent years, there has been increasing public concern regarding the poor reading achievement of many students nationwide (National Reading Panel, 2000). Of particular concern is the reading performance of students with disabilities, who make up a significant proportion of students with reading problems. According to the 29th Annual Report to Congress on the Implementation of the Individuals with Disabilities Education Act (2007), nearly 15% of school-aged children received special education services in the 2006-2007 academic year. The current study investigated the reading achievement across time of students receiving special education services who struggle with reading. The impact of instructional group size (individual, small group), teacher qualifications (experience, education, professional development) and child-instruction interaction (i.e., degree to which instruction is differentiated to address student skills) on reading achievement was examined using latent growth modeling. Teacher qualifications (experience, education, and professional development) did not predict reading growth. Frequency of small group instruction impacted reading comprehension but not fluency, whereas, frequency of individual instruction did not appear to impact either reading outcome. Results provided evidence that supports a positive association between degree to which instruction is aligned with student reading skill and reading growth. Thus, this study extends results from general education regarding the relationship between child-instruction interaction and reading growth (e.g., Connor, Jakobsons, Crowe, & Meadows, 2009) to a large sample of upper elementary students in special education.

Copyright by
LARISSA ANNE MORLOCK
2011

To my beloved father, Kenneth Morlock

ACKNOWLEDGMENTS

It is a great pleasure to thank those who made the completion of this dissertation possible. I am indebted and truly grateful to my advisor and dissertation chair, Dr. Sara Bolt, whose guidance and thoughtful critique of my work have been invaluable throughout the dissertation process. I would also like to sincerely thank the members of my dissertation committee, Dr. Ryan Bowles, Dr. Matthew Diemer, and Dr. Troy Marriage, each of whom went out of their way to support my dissertation research. Finally, I would like to offer my heartfelt gratitude to my family and especially my husband for their unfaltering support and belief in me.

TABLE OF CONTENTS

LIST OF TABLES

CHAPTER 1

INTRODUCTION

In recent years, there has been increasing public concern regarding the poor reading achievement of many students nationwide (National Reading Panel, 2000). This concern is well warranted given that the demands of the U.S. economy require rapidly increasing levels of literacy for employment (Snow, Burns, & Griffin, 1998). At the same time, a significant proportion of elementary school students do not have the reading skills needed for learning. For example, approximately 34 percent of fourth grade students performed at or below the Basic level on the National Assessment of Educational Progress (Lee, Grigg, & Donahue, 2007), which is indicative of an inability to comprehend grade level text.

Of particular concern is the reading performance of students with disabilities, who make up a significant proportion of students with reading problems. According to the 29th Annual Report to Congress on the Implementation of the Individuals with Disabilities Education Act (2007), nearly 15% of school-aged children received special education services in the 2006-2007 academic year. Almost half of these students had learning disabilities, the majority of which were in the area of reading. There is a large body of research indicating that prior reading performance is a powerful predictor of subsequent reading performance (e.g., Aunola, Leskinen, Onatsu-Arvilommi, & Nurmi, 2002; Shaywitz, Holford, Holahan, Fletcher, Steubing, Francis, & Shaywitz, 1995), and remediation programs for students with disabilities are rarely successful in helping them to close the achievement gap with their peers in general education (Hanushek, Kain, & Rivkin, 1998; Scarborough & Parker, 2003). A primary reason that remediation programs are often unsuccessful for students with disabilities is that they tend to rely on general instructional approaches for improving reading skills, rather than specifically tailoring the focus of instruction to address student needs (Moody, Vaughn, Hughes, & Fisher, 2000).

Over the last several decades, researchers have debated what constitutes effective reading instruction, word-based (phonics) or meaning-focused (whole language) instructional approaches (Rayner, Foorman, Perfetti, Pesetsky, & Seidenberg, 2001). The former involves explicit instruction in the alphabetic principle (NRP, 2000), whereas the latter emphasizes that learning to read is a natural and enjoyable process that draws heavily on a child's experience with language and should involve authentic experiences with literature (Goodman, 2005). Even though research shows that both approaches are integral to learning to read (Pressley, 2006; Snow, Burns, & Griffin, 1998), it is still unclear what proportion of instructional time should be allocated to word-level as opposed to meaning-based activities for a particular child (Connor, Morrison, & Katch, 2004).

Fortunately, researchers have attempted to address this question by examining whether the degree of alignment between child characteristics and instructional practices relates to reading achievement, or what Connor and her colleagues refer to as *child-instruction interactions.* For example, an observational study conducted by Connor, Morrison and Katch (2004) provided evidence that the effectiveness of particular instructional activities varies by children's initial skills. They found that students with lower initial decoding skills showed more growth when they received primarily explicit decoding instruction, while students with higher initial decoding skills showed more growth if they received primarily implicit instruction. Similar findings have been obtained in a number of studies investigating the reading growth of general education students in preschool (Hatcher et al., 2004), kindergarten (Foorman et al., 2003), first grade (Connor, Morrison, & Katch, 2004; Juel & Minden-Cupp, 2000), second grade

(Foorman et al., 1998), and third grade (Connor, Jakobsons, Crowe, & Meadows, 2009). Emerging from this research is a growing consensus that instruction that attends to child-instruction interactions is a promising avenue for promoting reading growth (Foorman, 2007).

Despite the promise of these findings, however, there is little empirical evidence that the findings would hold for students receiving special education services. As Torgesen and colleagues note, “there is little consensus about the nature and balance of specific instructional activities for children with severe reading disabilities” (Torgesen, Alexander, Wagner, Rashotte, Voeller, & Conway, 2001, p. 35). In part, this may be because research on the effectiveness of child-instruction interactions for facilitating reading growth has been typically conducted by researchers interested in the prevention rather than the remediation of reading problems (e.g., Connor, Morrison, & Katch, 2004; Foorman et al., 1998; Juel & Minden-Cupp, 2000), which points to the need for research specifically focused on students with disabilities.

Therefore, the purpose of this study is to explore the reading growth of upper elementary school students receiving special education services who struggle with reading. The primary contribution of this study is to determine whether the relation between child-instruction interaction and reading growth established within the general education literature is also found for students receiving special education services. Four research questions are addressed, which are as follows.

1. What is the relationship between child-instruction interaction and change in the reading achievement of elementary school students receiving special education services who struggle with reading?

2. What is the relationship between teacher quality (teacher education, experience, and professional development) and change in the reading achievement of elementary school students receiving special education services who struggle with reading?
3. What is the relationship between instructional grouping size (small group instruction and individual instruction) and change in the reading achievement of elementary school students receiving special education services who struggle with reading?
4. What is the relative influence of child-instruction interaction, instructional group size, and teacher quality on the reading achievement of elementary school students receiving special education services who struggle with reading?

CHAPTER 2

LITERATURE REVIEW

This chapter begins with a review of existing literature relevant to the prediction of reading growth in students with disabilities. The review begins with an overview of influential school learning theories that have attempted to explain the mechanisms underlying academic achievement. Next, recent empirical research that has tested hypothesized causal models using sophisticated, multivariate statistical techniques (e.g., path analysis) is described, followed by a review of research that has identified predictors of reading achievement using more traditional statistical techniques (e.g., standard multiple regression). A description of the limitations of existing research follows and the chapter concludes with an explanation of how this study will address these limitations.

Existing Research

School Learning Theories

Carroll (1963) developed one of the first theories of school learning, which inspired a tradition of research exploring predictors of academic achievement that continues today. Carroll's theory was an extension of a study he conducted on foreign language learning. This study showed that factors such as an individual's aptitude, ability to understand educational materials, and the quality of instruction he or she received were related to the time it took to achieve a given criterion. Carroll hypothesized that this model could be applied more widely to learning in many domains. Therefore, this research served as the foundation for the development of his more generic school learning theory (Carroll, 1989).

Carroll's theory purports that school learning is a function of *time spent learning* (Carroll, 1963, 1989). According to Carroll, time spent learning is determined by three factors, *time* *needed to learn, perseverance,* and *time allowed (opportunity).* Time needed to learn is determined by a child's *aptitude*, *ability to understand instruction*, and *quality of instruction*. Aptitude is described in this model as the time a highly motivated individual needs to learn a particular task when he or she receives high quality instruction. Ability to understand instruction is an individual's language comprehension and his or her ability to independently identify the learning task and the means by which to learn it. Quality of instruction is not clearly defined; however, the theory does specify that high quality instruction should include communicating to the learner what they must learn, sufficient engagement with educational materials, and appropriate sequencing of instructional activities. Perseverance is the time an individual spends learning a particular task. Carroll considered perseverance the operational definition of motivation to learn. Time allowed (opportunity) for learning is the time provided to learn a particular task and is influenced by the quality of instruction. Adequate engagement with educational materials is necessary for high quality instruction. This theory introduced many important predictors of academic achievement and was the first attempt to conceptualize the interrelationships between multiple predictors of school learning such as student ability, motivation, and the quality of instruction (Keith, 2002). A large body of research has accumulated since the development of this theory that supports the centrality of these factors to academic achievement.

In 1976, Harnischfeger and Wiley developed a theory of school learning that addressed the concept of time spent learning in considerably more detail by distinguishing between *allocated learning time* and *active learning time.* Active learning time, or time-on-task, is considered the primary causal agent in the theory; all other influences exert their impact on learning through this construct. According to this theory, the amount of active learning time an individual devotes to a topic is the primary cause of his or her academic achievement in that domain. Allocated learning time is simply the amount of time allotted for learning. There are seven categories of allocated learning time, which include: (1) whole-class instruction, (2) supervised small-group instruction, (3) supervised individual instruction, (4) unsupervised group instruction, (5) unsupervised individual instruction/seatwork, (6) transitions, and (7) out-of-school pursuits such as homework. Harnischfeger and Wiley argue that subgroup and individual instruction may be more effective than whole-class instruction. In addition, they purport that for researchers, "the question is not whether individualization is more effective than group work, but rather which mixtures of groupings and individualization work for which kinds of pupils, teachers, and subject matters" (p. 21). This theory extends Carroll's theory by including specific instructional practices such as grouping formats. Carroll's consideration of instruction was limited to the concept of instructional quality, which was not clearly defined.

Walberg's Theory of Educational Productivity (Horn & Walberg, 1984; Walberg, 1981, Walberg, Fraser, & Welch, 1986; Walberg & Shanahan, 1983; Walberg & Tsai, 1985) includes a greater breadth of contextual factors than either of the theories already discussed. The theory asserts that characteristics of individuals and their educational environment interact to facilitate learning. To create this theory, Walberg and his colleagues identified and classified constructs in the Carroll and Harnischfeger-Wiley theories, as well as six other school learning theories. Walberg's analysis indicated that there were eight constructs present across theories that seemed relevant for school learning. The four constructs he found most frequently in these theories are considered the primary determinants of school learning in his model. These include ability, motivation, quality of instruction, and quantity of instruction. The four secondary (and more distal) predictors in the model are thought to influence learning indirectly; these include the social and psychological environment of the classroom, the home environment, peers, and mass media.

Studies have empirically examined the relationship between hypothesized predictors in school learning theories and academic outcomes. In the next section, this research is reviewed. The focus of the review is on the findings of complex, multivariate models that have explored hypothesized mechanisms underlying academic achievement. Sophisticated statistical modeling techniques that allow for investigation of the interrelationships among multiple predictors simultaneously offer potential advantages over methods which explore fewer predictors concurrently. According to Keith (2002), these techniques allow the researcher to examine the relative influence of a number of predictors, as well as to determine how predictors interact with one another to influence achievement. He goes on to note that by allowing the researcher to explore direct, indirect, and total effects, these models can provide useful information for the generation of hypotheses regarding potential causal mechanisms underlying reading growth.

Empirically-Tested Models

Walberg's theory of Educational Productivity has received extensive testing using multivariate, structural (path) statistical models that examine the interrelationships among predictors. Walberg and colleagues have repeatedly tested his model (e.g., Reynolds, 1992; Reynolds & Walberg, 1992a, 1992b, 1992c; Walberg, Fraser, & Welch, 1986). In addition, "generic" models of school learning that were influenced by Walberg's theory have also received considerable empirical investigation by Keith and colleagues (e.g., Keith & Benson, 1992; Keith & Cool, 1992). These models predict the science and math achievement of high school students (Anderson & Keith, 1997; Parkerson, Lomax, Schiller, & Walberg, 1984; Reynolds, 1992); however, less is known about their applicability to different populations and content areas.

According to Keith (2002), the ordering and impact of variables in these models would likely change if they were applied to students of varying ages. Keith and Walberg have tested these models primarily with students in general education (e.g., Anderson & Keith, 1997; Reynolds & Walberg, 1992a), whereas this study will investigate the school learning of students in special education.

Other researchers have developed and empirically tested their own models of academic achievement. For example, DiPerna and Elliott (2000, 2002) developed the Academic Enablers model, which aims to explain the interrelationships among individual predictors and academic achievement. According to these researchers, academic enablers are student attitudes and behaviors that facilitate academic achievement. The model purports that the largest influence on current academic achievement is prior academic achievement. Motivation influences academic achievement through study skills and engagement and is influenced by prior academic achievement and interpersonal skills.

The Academic Enablers model contributed to the school learning literature by investigating how individual differences in motivation, study skills, engagement, and interpersonal skills interact to influence learning. Prior to this model, no multivariate model explaining the interrelationships amongst these individual variables and academic achievement existed (DiPerna & Elliott, 2002). Educators may find this model helpful for identifying some of the individual factors that contribute to a child's reading progress. However, since the model excludes characteristics of instruction, educators will need to look to other literature to determine how to intervene to enhance these individual factors.

A few years after DiPerna and Elliott's publication of their model, Connor and her colleagues (2005) developed and tested two models of reading achievement, using path analysis of cross-sectional data. The first model included a core system of instruction, which consisted of teacher qualifications (experience, education), as well as characteristics of instruction (e.g., teacher warmth, responsivity). This model was informed by Cohen, Raudenbush and Ball's (2003) call for researchers investigating the effects of school resources to explicitly examine the role instruction may play in the degree to which particular resources predict student achievement gains. They argue that most of the existing research has simply correlated school resources, such as teacher qualifications, with student achievement without consideration of the instructional practices used by teachers that are responsible for increased student achievement. An understanding of the influence of instruction is necessary to ensure that schools effectively use resources. Connor and colleagues' second model included the same core system of instruction with the addition of contextual factors that are beyond the influence of schools such as SES, the child's reading skills at 54 months of age, and characteristics of the home.

Connor and colleagues' analysis of these models provided some evidence that the relationship between school resources (teacher education and experience) and student achievement is mediated by instructional practices. Specifically, they found that teachers with more education and fewer years of experience demonstrated more warmth and responsivity during instruction than teachers with less education and more years of experience. In addition, teacher warmth and responsivity were positively related to student's vocabulary scores. The authors explain their results by arguing that years of teaching experience do not necessarily lead to improved instructional skill if teachers are not provided with the means by which to improve their skills and instead repeat ineffectual instructional practices from year to year. They argue, therefore, that it may be important for future research to examine the relationship between professional development experiences and teacher's instructional practices.

Predictors

In addition to research examining complex multivariate models such as those described in the previous section, there is also a vast body of research that has examined individual and contextual predictors of academic achievement using methods that explore fewer predictors simultaneously. This section will review the literature on two of these predictors, prior academic achievement and teacher qualifications. Prior academic achievement is included in this study because it has repeatedly been found to be the most robust predictor of academic growth in multivariate models (e.g., Anderson & Keith, 1997; DiPerna & Elliott, 2000, 2002). Teacher qualifications are included in this study because they are the focus of much theoretical and empirical study within the field of education. Further, although the relationship between teacher qualifications and student achievement is equivocal (e.g., Hanushek, 1981, 1986, 1989, 1997), it has received increasing attention in recent educational policy (e.g., No Child Left Behind; see DOE, 2004a, 2004b).

Teacher quality. A large body of research on teacher qualifications exists within the policy literature on school resources. Coleman and colleagues' (1966) seminal study marked the beginning of significant interest among educational researchers in the relationship between school resources and student achievement (Hanushek, 1997). The authors found that the relationship between school resources, such as teacher qualifications, and student achievement was negligible. Teacher quality has been defined in terms of teacher characteristics and qualifications, such as teacher education, experience, and training (Cochran-Smith & Fries, 2005). The findings of studies exploring the link between teacher qualifications and student achievement have been equivocal (Connor et al., 2005). Hanushek conducted four syntheses of the literature (1981, 1986, 1989, and 1997) and consistently found that the correlation between teacher qualifications (education, experience) and achievement was weak or non-existent. For example, in 1997 Hanushek found that of the studies he reviewed investigating the relationship between teacher experience and student achievement, only 29% found a significant correlation, while of those studies he reviewed investigating the relationship between teacher education and student achievement, only 9% found a significant correlation. According to Hanushek, “These results have a simple interpretation: There is no strong or consistent relationship between school resources and student performance” (p. 148).

Another group of researchers, Greenwald, Hedges and Laine (1996), conducted a meta-analysis of the literature and drew different conclusions regarding the relationship between school resources and student achievement. These researchers employed different methodology – combined significance testing and effect magnitude estimation - for synthesizing the research, which led to different results. A strong relationship was found between teacher qualifications (i.e., experience, education) and student achievement.

Given the inconsistency of the findings examining the relationship between teacher qualifications and student achievement, it is difficult to draw conclusions with confidence. However, equivocal findings in the literature may be partially due to the types of questions researchers exploring the link between teacher qualifications and student achievement have asked. This research has often relied on cross-sectional data (e.g., Connor et al., 2005). Therefore, studies have frequently involved correlating teacher qualifications with student achievement at the same time point. One disadvantage of this design is that it does not allow the researcher to investigate whether presumed cause precedes effect, a requirement of causal inference. Thus, studies with longitudinal, as opposed to cross-sectional, designs offer the advantage of allowing for examination of the temporal ordering of variables (Schneider et al., 2007).

In addition, Cohen and colleagues (2003), argue that studies investigating the link between school resources, such as teacher qualifications, and student achievement have tended to ignore the influence of instruction, instead correlating school resources with student achievement. Although there is a need for more research exploring the link between teacher qualifications and instructional practices (Connor et al., 2005), some recent research has examined this association. In 2002, the National Institute of Child Health and Development (NICHD, 2002) examined the relationship between teacher qualifications (experience, education) and characteristics of instruction (emotional support provided to students by teachers, and amount of time devoted to academic instruction). There was a small relationship found between experience teaching first grade and time spent on academic instruction; however, experience did not predict the amount of support provided. Education obtained predicted both time spent on academic instruction and emotional support.

The relationship between teacher qualifications and instructional practices was also examined by Connor and colleagues (2005). These authors extended the findings of the study conducted by the NICHD by simultaneously examining the relationship between teacher qualifications (education, experience) and instructional practices, as well as the relationship between instructional practices and student achievement. Similar to the results obtained in the study conducted by the NICHD, Connor and colleagues found that teachers with more education and less experience exhibited more warmth and responsivity during instruction than teachers with less education and more experience. Further, this emotional support was positively correlated with student’s vocabulary skills. As noted by Connor and colleagues, other teacher quality indicators, such as professional development experiences, may influence the degree to which teacher experience is associated with improved instructional practices.

A few years later, Connor and her colleagues published the results of a study investigating the link between professional development, instructional practices, and student reading achievement (Connor, Morrison, Fishman, Schatschneider, & Underwood, 2007; Connor, Piasta, Fishman, Glasney, Schatschneider, Crowe, Underwood, & Morrison, 2009). In response to evidence that child-instruction interactions consistently predict student reading growth (e.g., Connor et al., 2004; Foorman et al., 1998; Hatcher et al., 2004), as well as evidence that the proportion of language arts instruction focused on various instructional activities varies significantly across classrooms (Juel & Minden-Cupp, 2000), Connor's group conducted a study exploring whether child-instruction interactions could be increased through instructional recommendations and professional development. Forty-seven first-grade teachers were assigned to treatment and control groups using cluster-randomization. Teachers in the treatment group were provided with recommendations for the number of minutes of instructional time to allocate to particular types of instruction for each student, which were derived from a student's initial reading and vocabulary scores. Further, these teachers received professional development on how to individualize reading instruction. Professional development consisted of three components: classroom management, individualizing the focus and delivery of instruction, and research-based instructional practices. Teachers in the control group did not receive professional development or recommendations regarding the amount of particular types of instruction.

On three occasions throughout the year, teachers were videotaped providing language arts instruction. Instruction was coded for the number of minutes spent on several dimensions of practice (e.g., grouping unit, content of instruction). Degree of child-instruction interaction was estimated by calculating the distance from recommendations (DFR) of instruction, which involved subtracting number of minutes of classroom instruction spent on various activities from the number of minutes that were recommended for a given child. The DFRs for children in the treatment group were smaller, which the authors suggested was likely due to more time spent working in small groups, and on meaning-focused instruction, which were emphasized in professional development (Connor, Morrison, Fishman, Schatschneider, & Underwood, 2007). Further, smaller DFRs were associated with greater student reading growth (Connor, Piasta, Fishman, Glasney, Schatschneider, Crowe, Underwood, & Morrison, 2009). However, as noted by the authors, since the treatment differed from the control in regard to two factors (professional development and recommendations regarding the allocation of instruction time), the relative contribution of these factors is unknown.

Nonetheless, one component of the professional development in Connor's study, a focus on increasing teacher knowledge of effective literacy instructional practices, has received empirical support. In an effort to understand how to facilitate teacher adoption of instructional practices aligned with policy initiatives, a number of researchers have explored aspects of professional development that seem to lead to teacher adoption of particular practices, as well as how these practices relate to student achievement (Brown, Smith, & Stein, 1996; Cohen & Hill, 2000; Kennedy, 1998; Wiley & Yoon, 1995). For example, Cohen and Hill (2000) compared the effectiveness of professional development for teachers focused on the specific curricular materials of a mathematics reform initiative, relative to professional development focused on special topics related to reform that did not involve learning about specific curricular content. They found that teachers who participated in professional development that involved learning curricular content demonstrated greater increases in their knowledge of the curriculum, as well as more alignment between the curricular reform and their instructional practices than their peers who did not learn about specific curricular content. Further, teachers with greater content knowledge of the reform curriculum who implemented practices that were more consistent with its tenets were able to facilitate greater student knowledge of mathematical concepts within the reform curriculum. Therefore, it seems that professional development that provides teachers with opportunities to increase their knowledge of academic content tends to lead to greater adoption of the instructional practices of interest, which leads to greater student achievement.

A few years later, Foorman and Moats (2004) found similar results linking teacher knowledge, instructional practices, and student reading achievement. The authors engaged in a 4-year project that involved work with school districts in Houston and the District of Columbia to increase the capacity of elementary schools to deliver evidenced-based literacy instruction and met with considerable success in raising the student achievement. Many aspects of the program differed between these sites but they shared similar approaches to professional development, which emphasized increasing teacher knowledge of curricular content. Teacher knowledge, resulting from professional development was measured with a multiple-choice test of curricular content (e.g., orthographic, phonological, and morphological dimensions of word structure) and teacher instructional effectiveness was assessed using classroom observations of the teacher's competence in regard to teaching routines and classroom management. Moderate, but significant relationships were found between teacher knowledge, instructional effectiveness, and student reading achievement, supporting previous research linking these variables (Bos, Mather, Dickson, Podhajski, & Chard, 2001; Cunningham, Perry, Stanovich, Stanovich, & Chappell, 2001; McCutchen, Abbott, Green, Beretvas, Cox, & Potter, 2002).

As noted by Rice (2003), current teacher quality research tends to measure this construct with indicators that are readily applicable to educational policy. As is evident from the studies reviewed thus far, this research often involves correlating teacher qualifications (e.g., education, experience) with student achievement and much of the research in this area has been conducted by educational policy researchers (Kennedy, 1996). Several recent, large-scale general education studies have investigated the link between teacher qualifications and student achievement (Darling-Hammond, 2000; Fenstermacher & Richardson, 2005; Humphrey & Weschler, 2005; National Commission on Excellence in Elementary Teacher Preparation for Reading Instruction, 2003). However, the applicability of these studies to students receiving special education is not known. In addition, although studies conducted by educational policy researchers frequently include students in both general and special education (e.g., Borland & Howsen, 1992; Hanushek, 1992); the findings are seldom reported separately for these two populations of students. This may be partially because the number of students with disabilities in these studies is not adequate for statistical analyses.

According to Blanton and colleagues (2006), the majority of research on teacher quality for special education populations has focused on the relationship between teacher behaviors and student achievement, what is referred to as process-product research. Findings from this research indicate that students with disabilities benefit academically when their teacher provides instruction and monitoring of classroom rules, consistent feedback on their performance, as well as instruction that is explicit, fast-paced, and maximizes active engagement (Berliner, 1984; Christenson, Ysseldyke, & Thurlow, 1989; Englert, Tarrant, & Mariage, 1992; Good, 1979; Rosenshine, 1986; Sindelar et al., 1986). Blanton and colleagues also note that very little research investigating the relationship between teacher qualifications and student achievement for students receiving special education are available, largely because special education researchers are not typically able to make use of large-scale, nationally representative datasets since the sample size is insufficient for statistical analyses.

Prior achievement. There has been considerable debate within the field of education regarding how prior performance predicts current performance. There are two ways in which educational researchers have examined the relationship between prior achievement and current achievement. The first approach involves examining the correlation between prior achievement and current achievement. Considerable research has provided evidence that prior achievement is a strong predictor of future achievement. Along with their colleagues, Walberg (e.g., Reynolds & Walberg, 1991; 1992a; 1992b; 1992c; Walberg, Fraser, & Welch, 1986) and Keith (e.g., Anderson & Keith, 1997; Cool & Keith, 1991) have repeatedly found that prior achievement is the strongest predictor of current achievement. This relationship is found with a variety of indicators of achievement such as grades (Walberg et al., 1986) and norm-referenced vocabulary assessments (Cool & Keith, 1991; Keith & Page, 1985).

The second way in which educational researchers have approached studying the relationship between prior achievement and current achievement is by investigating whether or not a *Matthew effect* exists. Shaywitz and colleagues (1995) refer to the Matthew effect as “the notion of cumulative advantages leading to still further advantage, or, conversely, initial disadvantage being accentuated over time” (p. 894). The existence of a Matthew effect would indicate that prior achievement not only predicts current achievement but also that the achievement gap between strong readers and poor readers widens over time. Stanovich (1984l 1986) theorizes that the Matthew effect occurs because reading facilitates growth in vocabulary, verbal IQ, and comprehension, all of which in turn, facilitate reading growth.

Studies investigating the existence of a Matthew effect have yielded inconsistent results. Williamson, Appelbaum, and Enpanchin (1991) found that the achievement gap between the strongest and the poorest readers widens after first grade, a finding that supports the existence of a Matthew effect. Studies examining the reading growth trajectories of kindergarten students have demonstrated that students with higher initial decoding skills demonstrate faster rates of growth than students with lower initial skills (Bast & Reitsma, 1997; Leppänen, Niemi, Aunola, & Nurmi, 2004).

On the other hand, there is evidence that is inconsistent with the Matthew effect hypothesis (Aunola, Leskinen, Onatsu-Arvilommi, & Nurmi, 2002; Philips, Norris, Osmond, & Maynard, 2002; Shaywitz et al., 1995). For example, in a longitudinal investigation of the reading growth of 445 students with and without disabilities from first through sixth grade, Shaywitz and colleagues (1995) found no Matthew effect for reading achievement. Leppänen, Niemi, Aunola and Nurmi (2004) found that whether or not a Matthew effect was found differed over time. These researchers found a Matthew effect when using children's beginning reading skills in preschool to predict their reading growth at the end of preschool; however, they did not find that children's reading skills at the beginning of first grade predicted their reading skills at the end of first grade. Students with the highest reading skills at the beginning of first grade still tended to have the highest reading skills at the end of first grade. Nonetheless, the gap between the skills of the highest and lowest achievers decreased over time.

One potential explanation for the inconsistent findings of research investigating the Matthew effect could be the tendency to ignore characteristics of instruction in these studies. One explanation Leppänen and colleagues (2004) offered for their failure to find a Matthew effect in first grade was that the focus of instruction provided in first grade was more closely aligned with the skill level of lower performing students than their higher performing peers. Recently, evidence has begun to accumulate indicating that the degree to which the focus of instruction is aligned with student skill level is related to children's reading growth (Connor et al., 2004; Foorman et al., 1998; Hatcher et al., 2004; Juel & Minden-Cupp, 2000). Therefore, it seems possible that the degree of alignment between student skill level and the focus of instruction may influence whether or not a Matthew effect is found in a particular study. For example, if instruction provided to first grade students in Leppänen and colleagues' study focused on explicit instruction in phonics, it would be better aligned with the instructional needs of students with weaker decoding skills at the beginning of first grade. Therefore, it is possible that the results were partially accounted for by the degree to which instruction aligned with student's instructional needs. However, characteristics of instruction were not reported, making evaluation of this potential explanation impossible.

Limitations of Existing Research

The empirical studies of multivariate models described in this review--Connor's model, DiPerna and Elliott's model, Walberg and Keith's models--have contributed to educator's understanding of the interrelationships among, and relative influence of, contextual and individual predictors of academic achievement. Although much attention has been devoted to investigating the influence of teacher qualifications on student achievement, findings are inconsistent (Hanushek, 1981, 1986, 1989, 1997). The tendency for researchers to overlook the role of instruction when studying this link may be partially responsible for the equivocal findings (Cohen et al., 2003). While some research has investigated the relationship between teacher quality indicators (education, experience), instructional practices, and student achievement (e.g., NICHD, 2002), future research is needed to explore the relationships among these variables and other teacher quality indicators such as professional development (Connor et al., 2005).

In addition, existing studies exploring the relationship between teacher qualifications, instructional practices, and academic achievement have used cross-sectional data (e.g., Connor et al., 2005). As noted by Schneider and colleagues (2007), studies with longitudinal, as opposed to cross-sectional, designs allow for investigation of the temporal ordering of a presumed cause and its effect. This is a considerable advantage over cross-sectional designs since one requirement for making causal inferences is that the cause precedes the effect. Therefore, research is needed to explore the relationships between teacher qualifications, instructional practices, and student achievement using longitudinal methods.

In regard to the influence of prior reading achievement on current achievement, it is not clear what type of growth trajectory most accurately represents change. Researchers have argued that the achievement gap between poor and strong readers either narrows (e.g., Aunola, Leskinen, Onatsu-Arvilommi, & Nurmi, 2002) or widens over time (e.g., Stanovich, 1986; Williamson, Appelbaum, & Enpanchin, 1991). Leppänen et al. (2004) refer to these two hypothesized trajectories of development as *compensatory* and *cumulative*, respectively. Although characteristics of instruction may influence whether or not a Matthew effect is found (Leppänen et al., 2004), studies have not typically given instruction much consideration. Therefore, future research investigating the relationship between prior achievement and current achievement that considers instructional practices is needed.

Recently, evidence has begun to accumulate indicating that particular characteristics of language arts instruction may play an important role in student reading growth. Research has found that alternative grouping practices (pairs, small groups, multiple grouping formats) for language arts instruction are associated with higher academic achievement for students with disabilities than whole-class instruction (Elbaum et al., 1999). In addition, an accumulating body of research suggests that the degree to which the focus of instruction aligns with student skill level is related to children's reading growth (e.g., Connor et al., 2004; Foorman et al., 1998; Hatcher et al., 2004; Juel & Minden-Cupp, 2000). The next two sections describe the research demonstrating the importance of these instructional practices for student reading growth, as well as gaps in the literature requiring future study.

Explicit versus Implicit Decoding Instruction

The focus of this portion of the literature review is on phonemic awareness, the alphabetic principle, and fluency because this study is concerned with the factors that are linked to a student's ability to decode text accurately and automatically. According to the NRP (2000), phonemic awareness is the ability to distinguish between and manipulate individual sounds in spoken language whereas the alphabetic principle is defined as knowledge of the sounds associated with specific letters and the ability to use those sounds to read text. The report created by the NRP also indicated that explicit instruction in the alphabetic principle is known as phonics instruction. Since phonemic awareness and the alphabetic principle are skills that must be mastered to accurately decode text (Juel & Minden-Cupp, 2000), they are prerequisites to reading fluency, which is the ability to automatically and effortlessly decode text (NRP, 2000).

According to the NRP, although phonemic awareness can be taught separately from the alphabetic principle, this infrequently occurs. If phonemic awareness instruction includes any reference to letters, it is considered phonics instruction. The NRP report goes on to state that phonics instruction always includes phonemic awareness instruction because phonics instruction involves teaching students how to use their knowledge of how spoken sounds are associated with particular letters or letter combinations to decode text. Therefore, it is impossible to do this without making reference to individual spoken sounds (phonemes) and their manipulation.

There is consensus within the literature that mastery of phonemic awareness and the alphabetic principle are prerequisite for learning to read. This conclusion is supported by the findings of many correlational (Adams, 1990; Juel, 1988; Tunmer et al., 1988) and experimental studies (Juel, 1988; Juel, Griffith, & Gough, 1986; Tunmer, Herriman, & Nesdale, 1988). The findings of studies examining the characteristics of young children with varying decoding skills provide further evidence of the importance of these beginning reading skills in learning to read. Young students with more developed phonemic awareness skills and knowledge of the alphabetic principle tend to learn to decode text more successfully than their peers with less developed skills (Juel, 1988; Juel et al., 1986; Tunmer et al., 1988), while those with deficits in these areas are more likely to struggle with decoding (Frith, 1981; Torgesen, 1985). Fortunately, a considerable body of research has shown that direct instruction in phonics is effective in increasing the phonological skills of these students (Ball & Blachman, 1991; Bradley & Bryant, 1983; Connor et al., 2004; Cunningham, 1990; Foorman et al., 1998; Hatcher et al., 2004; Juel & Minden-Cupp, 2000; Lundberg, Frost, & Peterson, 1988; Olofsson & Lundberg, 1983, 1985).

According to Juel and Minden-Cupp, it is unlikely that the effectiveness of phonics instruction for helping struggling readers learn to decode text is solely caused by explicit instruction of letter-sound associations. The authors argue that this is because phonics programs typically include a maximum of approximately 90 of these sound-association rules, whereas decoding in English requires the use of more than 500 sound-association rules (Gough, Juel, & Griffith, 1992; Juel, 1994). Instead, Juel and Minden-Cupp argue that phonics instruction may be effective because it increases phonemic awareness as well as knowledge of these alphabetic rules. If you consider the ratio of rules taught in phonics instruction to the number of rules required for students to actually successfully sound out words, it seems unlikely that the explicit instruction of the rules, in and of itself is the reason that phonics instruction helps students learn to decode. Therefore, it may not be that explicit instruction in the rules of phonics but instead the awareness that letters and letter combinations encountered in text are associated with speech sounds that allows students to learn to read. Once students have some knowledge of phonics rules and awareness that letter and letter-combinations are associated with particular speech sounds, they have the competencies they need to read text independently and teach themselves the letter-sound rules that they do not yet know (Juel & Minden-Cupp, 2000). Juel and Minden-Cupp's view on the role that explicit instruction in phonics has on the development of decoding skills is consistent with the self-teaching hypothesis (Share, 1995; Share & Stanovich, 1995; Torgesen & Hecht, 1996); which indicates that learning to read involves phonemic awareness, knowledge of some phonics rules, as well as several opportunities to decode new words. According to the self-teaching hypothesis, phonics instruction should provide students with the skills they need to be able to decode text on their own. Once a student is at that point of skill development, he or she will benefit more from ample opportunities to read independently than he or she will from phonics instruction.

Some recent research has begun to explore the possibility that the effectiveness of instructional practices may vary with the skill level of the student (Connor et al., 2004; Foorman et al., 1998; Hatcher et al., 2004; Juel & Minden-Cupp, 2000). In a quasi-experiment with 285 first and second grade students, Foorman and colleagues (1998) found that students at-risk for reading failure benefit more when they received instruction emphasizing explicit phonics. There were three instructional conditions in the study: (1) direct code, (2) embedded code, and (3) implicit code. The direct code condition consisted of explicit instruction in letter-sound correspondences practiced in decodable text. Embedded code instruction consisted of less direct instruction in systematic sound-spelling patterns embedded in connected text, whereas, the implicit code group received implicit instruction in the alphabetic code while reading connected text. These researchers found that students receiving direct code instruction improved in word reading at a faster rate and had higher word-recognition skills than students receiving either of the other two types of instruction.

Similar results were obtained by Juel and Minden-Cupp (2000). In an observational study, the authors examined word recognition instruction in four first grade classrooms with a large proportion of students at-risk for reading failure. They found that students with lower initial skills made more reading growth in classes with greater instructional emphasis on word recognition. Further, they found the opposite to be true of students with higher initial skills; these students showed more growth in classes with less explicit emphasis on word recognition.

In a longitudinal study, Hatcher, Hulme and Snowling (2004) investigated the effectiveness of three whole-class instructional conditions with strong phonic components (Reading with Rhyme, Reading with Phoneme, Reading with Rhyme and Phoneme) as compared to a control condition for enhancing the reading skills of 410 preschool children. They found that for typically developing readers, the experimental conditions were no more effective than the control condition in facilitating reading growth. For students with deficits in phonological processing skills, on the other hand, instruction emphasizing phonics was more effective than instruction in the control condition. This finding is consistent with that of other researchers who have examined the effects of explicit instruction in phonological skills relative to less explicit instruction for at-risk students in first and second grade (Foorman, Francis, Fletcher, Schatschneider, & Mehta, 1998; Juel & Minden-Cupp, 2000).

Hatcher and colleagues found systematic phonics instruction allowed students at-risk for reading problems to increase their rate of growth such that it was commensurate with their peers. As the authors noted, the results of this study indicate that it is possible to prevent the steady decline in reading achievement of at-risk students, relative to their peers. At-risk students, who received systematic phonics instruction, were able to increase their performance rate to that of their peers within two years of school.

The findings of a study conducted by Connor, Morrison, and Katch (2004) added to previous research on child-instruction interactions by providing more clarity regarding what types of instructional activities may be most helpful for students with higher initial decoding skills. The studies previously reviewed (Hatcher et al., 2004; Juel & Minden-Cupp, 2000) indicated that students with higher initial skills benefit more from more balanced instruction with less explicit focus on phonics; however, they did not provide much detail regarding the types of instructional activities these students received. Consequently, it is unclear which instructional activities were most beneficial for students with higher initial skills.

On the other hand, the findings of Connor and colleagues' (2004) longitudinal, observational study of first grade students in general education provides insight regarding the instructional activities that may be most beneficial for students with differing initial skills. The authors coded word-recognition instruction on several dimensions such as the degree to which it was explicit versus implicit. Explicit decoding instruction included direct instruction in phonics (e.g., instruction in blending, rhymes, letter-sound correspondence), whereas implicit decoding instruction included activities that were also aimed at increasing student's decoding skill but would do so implicitly, or without direct instruction (e.g., teachers reading to class, discussions regarding books, silent reading, independent writing). They found that students with higher initial skill level showed more growth in decoding skills if they received primarily implicit decoding instruction. On the other hand, students with lower skill level (vocabulary and decoding) at the beginning of first grade showed more growth in decoding skills by the end of first grade if they received primarily explicit decoding instruction.

The studies reviewed thus far investigated whether particular instructional approaches could prevent young students at-risk for reading failure from developing reading difficulties. Studies have also explored whether older students who have already developed reading problems derive similar benefit from these types of instruction. A meta-analysis conducted by Scammacca and colleagues (2007) for the Center on Instruction synthesized the research on instructional interventions for adolescent struggling readers. The analysis included two types of interventions relevant to this study, word study and fluency interventions. *Word study interventions* included any intervention focused on accurate decoding (i.e., interventions targeting phonemic awareness and/or the alphabetic principle). Results indicated that word study interventions had a moderate effect on reading rate and accuracy ($\underline{d} = 0.60$) and reading comprehension ($\underline{d} = 0.40$). Thus, it seems that older struggling readers benefit from explicit instruction in beginning reading skills.

It is not clear whether Scammacca and colleagues' (2007) findings hold for students with disabilities since only one study included that investigated the effectiveness of word study interventions for this population. However, this study, conducted by Bhat, Griffin, & Sindelar (2003) did provide preliminary evidence that word study interventions may be effective for students with disabilities. The authors investigated whether direct instruction in phonemic awareness facilitated growth in this skill among middle school students with learning disabilities and phonological awareness deficits (n = 40) and whether any increase in phonemic awareness was associated with subsequent growth in decoding skills (word identification). This question was addressed using a within-group repeated measures design. Prior to the intervention, students' phonemic awareness and decoding skills were assessed using the Comprehensive Test of Phonological Processes (C-TOPP; Torgesen, Wagner, & Rashotte, 1999) and the word identification subtest of the Woodcock Reading Mastery-Revised (WRMT-R; Woodcock, 1987), respectively. Students were divided into two matched groups, A and B, using their phonemic awareness pretest scores. Next, Group A received explicit instruction in phonemic awareness for approximately four weeks while Group B served as the control. At the end of four weeks, students' phonemic awareness skills were assessed again, followed by Group B receiving the same intervention for approximately four weeks while Group A served as the control. At the end of the intervention, students' decoding skills were again assessed.

Bhat et al. (2003) found that direct instruction in phonemic awareness increased students' phonemic awareness skills since Group A had significantly higher phonemic awareness scores at mid-test than Group B (ES = 1.56) and Groups A and B had significantly higher phonemic awareness scores at post-test than at mid-test (ES = 0.15). Although the intervention seemed to facilitate growth in both phonemic awareness and decoding skills, the findings did not support the authors' expectations that increased phonemic awareness skills would transfer to increased decoding skill (no significant differences in the growth of Group A relative to Group B over their respective control periods).

As noted by Bhat and colleagues (2003), the finding that increases in phonemic awareness did not transfer to word identification may have been partially due to the focus of the intervention. All students in the study received an intervention that targeted phonemic awareness alone with no attention to letter-sound correspondence. Some studies have suggested that the combination of both instruction in phonemic awareness and the alphabetic principle is necessary for increased phonemic awareness to transfer to increases in word identification skills (Ball & Blachman, 1991; Brady, Fowler, Stone, & Winbury, 1994; Vellutino & Scanlon, 1987).

Additional studies not included in Scammacca et al.'s (2007) meta-analysis have explored the effectiveness of phonics instruction for older students with disabilities and have obtained mixed results. Foorman, Francis, Winikates, Mehta, Schatschneider, and Fletcher (1997) compared the growth of three groups of second and third grade children with reading disabilities who received different types of reading interventions. One group received direct instruction in analytic phonics, which involved teaching students how to segment words into onset (first consonant, consonant blend or consonant cluster in a syllable) and rime units (the vowel and consonants at the end of the syllable). A second group of students received a synthetic phonics intervention, which involved instruction in segmentation of words into letter-sound units. The third group received a sight word intervention in which they were taught words as a single unit. Findings indicated that students in the synthetic phonics group demonstrated significantly more growth in phonological decoding skills; however, this finding did not hold once the influences of covariates (verbal IQ and demographic characteristics of students) were removed from the analysis.

In their experimental study, Lovett and Steinbach (1997) found that phonological deficits can be remediated in older students with direct phonics instruction. Students with severe reading disabilities in second through sixth grade (n=122). Students were randomly assigned to one of three interventions. One treatment group received a phonics intervention, which focused on blending and letter-sound correspondence. A second treatment group received an intervention, which involved instruction in four decoding strategies (word identification by analogy, seeking part of the word that you know, attempting variable vowel pronunciations, and “peeling off” prefixes and suffixes). Students in the third group served as the control for this study and received instruction in general academic survival skills such as organization. Findings indicated that students in both of the treatment groups demonstrated significantly more growth in decoding skills than students in the control group. Further, the progress made by students was comparable regardless of age. The authors concluded that students across second through sixth grade may benefit from phonological training.

Further support for the effectiveness of phonological training for older students with disabilities was found by Oakland, Black, Stanford, Nussbaum, and Balise (1998). The authors compared the reading growth made by students who received an explicit phonics intervention along with the reading instruction typically provided by their schools (treatment group) and students who solely received the existing reading instruction provided by their schools (control group). Findings indicated that after the two-year intervention, students who received explicit phonics instruction demonstrated significantly more growth in decoding and reading comprehension. Like Foorman et al.’s (1997) study, students were not randomly assigned to intervention groups but were instead matched on relevant characteristics. Despite attempts to create comparable groups, some differences did exist, which may have favored the control group (students in the control group scored slightly higher than those in the treatment group on oral language and SES). Consequently, the authors argued that the effectiveness of the explicit phonics instruction as compared to the control may have been underestimated in this study.

Although further research is needed before conclusions can be drawn regarding the effectiveness of interventions targeting phonemic and alphabetic knowledge for older students with disabilities, the findings of the studies reviewed suggest that this is a promising area for future research (Bhat et al., 2003). It seems possible that the effectiveness of direct instruction in beginning reading skills for older students with disabilities will partially depend on the skill level of the particular student. That is, one might expect that the degree of alignment between the focus of instruction and student skill will influence the reading achievement of older students with disabilities in similar ways to how it has been shown to influence the reading achievement of younger students (e.g., Connor et al., 2004; Foorman et al., Hatcher et al., 2004; Juel & Minden-Cupp, 2000). For example, a student reading very slowly but at a high level of accuracy, might be expected to benefit more from intervention targeting reading fluency than he or she might from intervention focusing on phonemic awareness and phonics skills that he or she has likely already mastered. In addition to word study skills, Scammacca et al. (2007) investigated the effectiveness of reading fluency interventions for older students. Results indicated that fluency interventions had a small effect (d = 0.26), on the reading rate, accuracy, and comprehension of older students with reading difficulties. Nonetheless, as noted by Roberts et al. (2008), these findings are difficult to interpret since the majority of studies included in the meta-analysis investigated repeated readings, an intervention that requires students to orally read the same passage several times consecutively. Roberts et al. (2008) go on to argue that while there is a strong empirical foundation for the effectiveness of repeated readings for young students, more research is needed to determine whether this is also true for older students.

In fact, Rashotte and Torgesen (1985) found that repeated readings may not be as effective as other fluency interventions for facilitating the reading development of older students with disabilities. The authors investigated the effectiveness of repeated reading as compared to non-repetitive reading for non-fluent upper elementary school students with learning disabilities.

Despite their slow decoding speed (<65 words per minute on a second grade passage), students had high reading accuracy (>=90% accuracy rate on the second grade passages), suggesting that their fluency difficulties were not caused by insufficient decoding skills. Each student participated in all of the three treatment conditions but in varying order. The intervention occurred over seven days and required students in all three conditions to read four stories and answered four comprehension questions (one question pertaining to each story). In Conditions 1 and 2, students would get a different passage to read each day of the intervention and were asked to read the passage four times each day. Therefore, students read a total of seven different passages in Conditions 1 and 2. Conditions 1 and 2 differed in that the seven passages in Condition 1 were unrelated to one another, whereas in Condition 2, the seven passages contained many of the same words. There was no repetition of passages in Condition 3. Therefore, students read 28 different passages in this condition. The reading fluency score obtained on the first passage read each day was used to estimate progress. A trend line was created for each student using these seven scores and the slope of this line served as the outcome measure for the study. Significant growth in reading speed was made in all three conditions and there was no significant difference in reading speed gains between Conditions 1 and 3; however, Condition 2 resulted in significantly greater gains in reading speed. The authors concluded that repeated readings may be no more effective in facilitating growth in reading speed than non-repetitive reading unless there is considerable word overlap in the passages students read across days. Although students demonstrated comparable gains in reading rate across repeated reading and non-repetitive reading conditions, students in the non-repetitive condition demonstrated superior growth in comprehension and word reading accuracy to that obtained by students in the repeated reading condition. Some researchers argue that non-repetitive reading may facilitate greater reading comprehension and accuracy because it provides students with greater exposure to varied vocabulary, topic content, and genres (Homan, Klesius & Hite, 1993; Wexler et al., 2008). In addition, Homan and colleagues (1993) caution that older students may view repeated readings as dull or believe that they have been asked to re-read a passage as a punishment for poorly reading the passage the first time.

The findings of the studies reviewed have significance for older students with disabilities who struggle with reading. There is some evidence that explicit phonics instruction may be effective for this population. However, more research is needed with older students with disabilities since studies have tended to focus on younger students at-risk for reading failure (Bhat et al., 2003). In regard to fluency, some researchers argue that non-repetitive reading may be a more appropriate intervention for older students who struggle with reading than repeated reading (e.g., Homan, Klesius, & Hite, 1993) and there is some evidence to suggest that it may also be more effective (Rashotte & Torgesen, 1985). However, more research on the effectiveness of non-repetitive reading for increasing reading achievement in older students with disabilities is needed (Wexler et al., 2008).

In addition, recent studies of young students have consistently shown that the degree of alignment between the student’s skill level and the focus of instruction affects the amount of reading growth made (e.g., Connor et al., 2004). It seems possible that similar child-instruction interactions may exist for older populations of students with disabilities. However, there appears to be a lack of research exploring these potential interactions in this population.

Instructional Grouping Practices. One potential way for teachers to increase child-instruction interaction may be through instructional grouping practices. Given the dramatic variability in skills sometimes found among students within the same class (Connor et al., 2009), teachers may struggle to provide instruction that is differentiated to each student's skill level when providing whole-class instruction. Individual or small group instruction targeting particular skills, on the other hand, may be a method by which teachers might achieve greater alignment of the focus of instruction to each child's skill level.

Provision of instruction individually or in small groups may also impact student achievement through other mechanisms. For example, as noted by Torgesen (2002), instruction in pairs or small groups increases academic engaged time, which has consistently been shown to lead to academic growth. Further, teachers may be able to provide more frequent feedback during individual and small group instruction than during whole-class or large group instruction. Feedback about performance has been shown to powerfully influence student achievement (Hattie & Timperley, 2007).

In their meta-analysis of grouping practices, Elbaum and colleagues (1999) compared the effectiveness of alternative grouping formats (pairs, small groups, multiple grouping formats) to whole class instruction for the reading growth of students with disabilities. Small groups were defined as any group of 3-10 students. Pairs were defined as any group of two students working together cooperatively or in a tutoring relationship. In tutoring dyads, students with disabilities acted as tutors, tutees, or reciprocal-tutors. Multiple grouping formats consisted of some specified combination of small group and paired grouping formats. They found an average effect size of 0.43 for alternative grouping practices, which indicates that student achievement was considerably higher when they received instruction in alternative grouping formats as opposed to whole class instruction. Small groups (3 students) yielded the highest effect size ($\underline{d}$ = 1.61). However, more research is necessary before this finding can be interpreted because of the small number of studies exploring small groups included in the analysis (4 studies).

The NRP's phonics committee also examined the effectiveness of different grouping practices. The results for all studies in the meta-analysis, which included students at varying ages and ability levels, indicated that there was no significant difference between effect sizes associated with different instructional grouping formats (individual tutoring, small group instruction, and whole class instruction). However, only 8 of the 38 studies included in the meta-analysis included students with disabilities. Of these 8 studies, 7 examined decoding and/or oral reading outcomes of explicit phonics instruction, whereas 1 study (Oakland, Black, Stanford, Nussbaum, & Balise, 1998) examined other reading outcomes such as spelling, comprehension, and non-word identification.

Seven of the 8 studies that included students with disabilities used small group instruction and found a wide range of effect sizes (-0.29 to 2.06), while only 1 used one-on-one instruction (Gittelman & Feingold, 1984) and found an effect size of 0.67. None of the studies investigated the effectiveness of explicit phonics within whole class instruction. Given the variability of effect size for small group instruction and the paucity of studies available that examine the relationship between group size and reading growth for student with disabilities, it is not possible to draw conclusions regarding the relative effects of different grouping formats for explicit phonics instruction at this time.

There was no overlap between the studies included in the NRP analysis and those included in the Elbaum analysis. This was likely due to differences in inclusion criteria. For example, the definition of *students with disabilities* in Elbaum and colleagues' study included students identified with learning disabilities, behavior disorders, neurological impairments, dyslexia, or emotional disturbances but not those identified with reading disabilities. The NRP analysis, on the other hand, did include students identified as having reading disabilities but not those with neurological, behavioral, or emotional disorders. Further, studies included in the NRP analysis were required to examine the effectiveness of phonics instruction; whereas, the studies included in Elbaum and colleagues' analysis could investigate the effectiveness of any type of reading or language arts instruction.

Purpose of Study

The purpose of this study is to describe and predict the reading growth of upper elementary school students receiving special education services who struggle with reading. The following four research questions are addressed.

1. What is the relationship between child-instruction interaction and change in the reading achievement of elementary school students receiving special education services who struggle with reading?
2. What is the relationship between teacher quality (teacher education, experience, and professional development) and change in the reading achievement of elementary school students receiving special education services who struggle with reading?
3. What is the relationship between instructional grouping size (small group instruction and individual instruction) and change in the reading achievement of elementary school students receiving special education services who struggle with reading?
4. What is the relative influence of child-instruction interaction, instructional group size, and teacher quality on the reading achievement of elementary school students receiving special education services who struggle with reading?

Consistent with previous findings, it is hypothesized that frequency of small group and individual instruction (Elbaum et al., 1999), teacher education and experience (Greenwald, Hedges, & Laine, 1996), and professional development in literacy instruction would be positively related to change in reading fluency and comprehension (e.g., Connor et al., 2007; Connor et al., 2009). In addition to these previously established relationships, it is predicted that child-instruction interaction would be positively related to change in reading achievement (fluency and comprehension). Although the relationship between child-instruction interaction and reading achievement has not previously been tested for students receiving special education services, this hypothesis is informed by literature from the general education literature, which has established the relationship between child-instruction interaction and children's reading growth (e.g., Connor, Morrison, & Katch, 2004; Foorman et al., 1998; Hatcher et al., 2004).

Given the shortage of empirical studies that have investigated the relative impact of child-instruction interaction, instructional group size, and teacher qualifications, analyses investigating these relationships in this study are exploratory and hypotheses are theoretically derived. It seems reasonable to argue that the degree of alignment between a child's academic skill level and the focus of instruction is essential to reading growth and therefore it is hypothesized that child-instruction interaction will account for more variance in student reading achievement than the other two hypothesized predictors (i.e., teacher qualifications and instructional group size). Connor and colleagues' (2009) finding that the relationship between teacher qualifications (experience and education) and student reading achievement was negligible once the influence of child-instruction interaction was considered is consistent with this hypothesis. The link between instructional group size and student achievement has strong empirical support (Elbaum et al., 1999), whereas, findings of studies exploring the link between teacher qualifications and student achievement have been equivocal (Conner et al., 2005). Thus, it is hypothesized that instructional group size would account for more variance in student reading achievement than teacher qualifications.

CHAPTER 3

METHOD

Data Source and Sample

The sample for this study consisted of a subset of students who participated in the Special Education Early Elementary Longitudinal Study (SEELS), which was funded by the Office of Special Education Programs (OSEP) of the U.S. Department of Education. The SEELs study involved the first large-scale direct assessment of the outcomes of special education services (Wagner, Kutash, Duchnowski, & Epstein, 2005). The purpose of the SEELS was to measure longitudinally the academic, social, vocational, and personal adjustment of students with disabilities between 6 and 12 years of age on December 1, 1999 (SEELS, 2005). Data were collected from a variety of sources (e.g., parents, students, and teachers) using a variety of instruments (e.g., survey, interview, and direct assessment) across three waves of data collection.

The SEELS used a stratified random sampling procedure that consisted of two phases. During the first phase, local education agencies (LEAs) and state-operated schools were stratified by geographic region, district size, and district wealth. The purpose of using stratified random sampling to select LEAs and state-operated schools for the study was fourfold: (1) to enhance accuracy of estimates by reducing the variance between strata, (2) to enhance the comparability of the SEELS findings with results from other analyses of large data sets, (3) to safeguard against the exclusion of rare types of LEAs, and (4) to allow for the exploration of claims that certain national policy initiatives have varying effects in different regions of the country or with districts of varying size. This stratification procedure resulted in the selection of 245 LEAs and 32 state-operated schools.

The second sampling phase involved selecting students to participate in the study from all students with disabilities in grades 2-7 who were enrolled in one of the selected LEAs or state-operated schools. LEAs and state-supported special schools provided rosters of all students meeting these criteria, which included their age and disability. These rosters allowed for the determination of the sample size necessary for each grade level and disability category to ensure the generalizability of findings to the national population of students with disabilities, as well as the national population of students in each disability category. For example, 100% of students who were deaf and/or blind on the roster for state-supported special schools were selected. Therefore, claims made about the national special education population as a whole from this data set require the use of sample weights.

The majority of students recruited for the study participated (85%). The total sample of students at the first data collection phase was 9,824. Recruited students were excluded from the study if their parent/guardian did not provide consent. Some of these students did not participate in the study because their parent/guardian refused to consent to their involvement (n = 455), others did not participate due to language barriers (n = 156), but the majority of parents of excluded students did not indicate the reason their child did not participate (n = 1,077) (SRI International, 1999).

Criteria for Selecting Data File Sample

A sub-sample of students was selected for the present study. Since the focus of the study is on the reading growth of struggling readers who receive special education services, only students with a goal in reading on their Individualized Education Plan (IEP) were included. On the survey, teachers selected one of five potential choices in response to the statement, "Student's primary goal for reading achievement." These choices were 1=reading at grade level, 2=improving general reading skills but not necessarily to reach grade level, 3=developing functional reading skills, 4=building pre-reading skills, and 5=no goals regarding reading achievement. The sample for this study consists of those students whose teachers selected any of responses 1-4 for their IEP reading goal.

Instruments

Data for the SEELS were collected from a variety of sources. These included direct assessments of students, parent/guardian interviews, teacher surveys, surveys of student's school program, and school characteristics surveys. The three instruments that were used for this study are described below (see Table 1 for approximate dates of data collection).

Direct student assessment. Between February and May of 2001, 2002, and 2004, students completed direct assessments. Their academic performance was measured using a variety of assessment tools. Data from the Passage Comprehension subtest of the Woodcock-Johnson III (WJ-III; Woodcock, McGrew, & Mather, 2001) and curriculum-based measurement in reading (CBM-R; Deno, 1985) were used for this study.

Parent/guardian interview.Data from parents were gathered through a phone interview or mailed surveys between March and June of 2000, 2002, and 2004. Parents provided information on a number of topics such as their child's school experiences, family interaction/involvement with the school, and household characteristics. This study used data from this measure on demographic characteristics of the child's family such as household income.

Teacher survey. A survey covering topics such as the setting and characteristics of the child's language arts instruction and the child's performance was completed by each student's language arts teacher. The sample of teachers who responded to the teacher survey included both special and general education teachers since some students were receiving language arts instruction from a special education teacher while others were receiving language arts instruction from a general education teacher. Teachers completed this assessment between February and May of 2001, 2002, and 2004.

Variables

This section includes a description of the variables investigated in this study. Predictor variables included teacher quality (experience, education, and professional development), instructional group size (small group and individual instruction) and child-instruction interaction (see Table 2). Household income, maternal education, gender, and age served as control variables and student reading growth was the outcome of interest.

Teacher qualifications. Measures of teacher quality for this study included teachers' self-reported experience, education, and professional development activities. Years of teaching completed served as the indicator of teaching experience and the highest degree earned represented teacher education level. Teachers also reported whether or not they had engaged in at least 8 hours of professional development in language arts, reading, English, or writing over the past 3 years. Score at the first wave of data collection provided the estimate of each of the teacher qualification variables.

Child-instruction interaction. The creation of the child-instruction interaction variable was guided by both theory and empirical research. According to the self-teaching hypothesis (Share; Share & Stanovich, 1995; Torgesen & Hecht, 1996), poor decoders benefit most from direct phonics instruction until they are able to decode text independently. Once they have reached this level of competence, they benefit more from frequent opportunities to read independently than from phonics instruction. Several studies have obtained findings consistent with the self-teaching hypothesis. Poor decoders demonstrate greater reading growth if they receive instruction heavily focused on direct phonics instruction (e.g., Foorman et al., 1998; Hatcher et al., 2004), whereas, strong decoders demonstrate more growth when they receive primarily implicit instruction involving activities such as silent reading (Connor et al., 2004; Connor et al., 2009).

Depending on the degree of alignment between student skill and the focus of language arts instruction, students were coded as high, medium, or low child-instruction interaction. The focus of instruction was determined by teacher ratings of how frequently the child practiced phonics/phonemic skills and how frequently the child had opportunities for silent reading during language arts instruction (never, rarely, sometimes, or often). Decoding skill level was determined by student reading accuracy scores on passages A and B of CBM-R at wave 2. Reading accuracy was computed by dividing the number of words read correctly by the total number of words the student attempted to read for each of the passages, and then averaging the two scores. According to Howell and Nolet (2000), students progressing well in reading should read a grade level passage with at least 95% accuracy. The authors indicate that reading accuracy ranging from 90-95% may be cause for concern, while accuracy below 90% indicates the student is struggling with decoding. Therefore, students who scored at or above the 95% accuracy level were coded as having stronger decoding skills while those who scored below the 95% accuracy level were coded as having weaker decoding skills.

Less accurate readers who were reported by teachers to have practiced phonics/phonemic skills more frequently than they engaged in silent reading during language arts were coded as high child-instruction interaction. In addition, students with higher reading accuracy at wave 2 who engaged in more silent reading than practice of phonics/phonemic skills during language arts were coded as high child-instruction interaction. Students with higher reading accuracy at wave 2 who practiced phonics/phonemic awareness more frequently than they engaged in silent reading during language arts were coded as low child-instruction interaction. Similarly, students with lower reading accuracy at wave 2 who engaged in more silent reading during language arts instruction than they practiced phonics/phonemic skills were coded low child-instruction interaction. Finally, if a student's teacher provided the same rating of the frequency that he or she read silently and practiced phonics/phonemic skills during language arts instruction, then this student were coded as medium child-instruction interaction. Coding of the child-instruction interaction variable is presented in Table 3. Wave 2 data were used to estimate child-instruction interaction because this is the time point at which the teacher survey corresponds to the direct assessment, that is, this is the time point at which the data regarding the focus of language arts instruction corresponds to the data related to student reading achievement.

Instructional group size. On the survey, the student's language arts teacher rated the frequency with which the child received language arts instruction in a small group and individually. At the first wave of data collection, teachers were asked to rate on a four-point scale (1=never, 4=often) the "frequency that the following instructional groupings are used for this student during language arts instruction:" (a) small group instruction and (b) individual instruction from a teacher.

Outcomes of Interest

Reading fluency. To assess reading fluency for this study, students' scores on two curriculum-based measurement passages in reading (R-CBM; eno, 1985) at three points of time were used. R-CBM is a formative assessment of reading fluency that requires students to read passages aloud as quickly and accurately as possible for one minute. The student's score on the passage is the number of words he or she read correctly in the allotted time.

R-CBM is a reliable and valid measure of reading achievement. Tindal, Marston, and Deno (1983) found that test-retest reliability ranged from .92 to .97, alternate-form reliability ranges from .89 to .94, and the median inter-rater reliability coefficient was .99. There is also strong evidence of the validity of R-CBM for measuring reading achievement. For example, studies examining the criterion-related validity of the assessment have found validity coefficients ranging from .73 to .93 (Deno, Mirkin, & Chiang, 1982), .60 to .84 (Fuchs, Tindal, & Deno, 1984), .59 to .90 (Marston & Magnusson, 1985), and .80 to .91 (Fuchs, Fuchs, & Maxwell, 1988). Further, R-CBM scores differentiate between students with disabilities and those without (Deno, Marston, Shinn, & Tindal, 1982; Shinn & Marston, 1985). A confirmatory factor analysis conducted by Shinn, Good, Knutson, Tilly, and Collins (1992) showed that R-CBM explains almost all of the predictable variance in reading achievement, providing evidence for the construct validity of this measure. Finally, Ikeda, Gruba, and Dunga (2000) conducted a study, which investigated the predictive validity of R-CBM. Results indicated that students' R-CBM scores in the fall and spring of second and third grade predicted their fourth grade reading comprehension scores on the Iowa Test of Basic Skills (ITBS) with 70-77% accuracy. Findings of recent research conducted by Christ and colleagues (e.g., Ardoin & Christ, 2009; Christ & Ardoin, 2009; Poncy et al., 2005) has called into question the reliability and validity of R-CBM. These articles show that large standard error may be introduced in the measurement of students' growth when passages vary across students due to differences in passage difficulty, which undermines the stability of progress monitoring outcomes. Thus, the use of these measures may be problematic when used by researchers/practitioners to guide decision-making about individual students, given that students may get passages of varying difficulty. However, these issues may not be problematic in the SEELS data set given that all students received the same passages as one another at each of the three waves of data collection. Further, this measure is not used to draw conclusions about individual students. Thus, R-CBM appears to be a psychometrically valid measure of oral reading fluency for the purposes of this study.

Reading comprehension. Student reading comprehension was assessed with the research edition of the Passage Comprehension subtest of the Woodcock Johnson Tests of Academic Achievement Third Edition (WJ-III; Woodcock, McGrew, & Mather, 2001). The WJ-III is a well-established, norm-referenced achievement battery with strong psychometric properties (Cizek, 2001). The internal consistency of the WJ-III achievement tests range from .88-.96. Further, WJ-III achievement tests have high criterion-related validity (.63-.85) with other reading indexes such as the Wechsler Individual Achievement Tests, Kaufman Tests of Educational Achievement, and the Wide Range Achievement Test-III for nine year old children (McGrew & Woodcock, 2001). According to Salvia and Ysseldyke (2001), the psychometric properties of the WJ-R reading subtests are acceptable for conducting research.

The Passage Comprehension subtest has frequently been used to measure reading comprehension (e.g., Klinger & Vaughn, 1996; Shankweiler et al., 1999; Young, Beitchman, Johnson, Douglas, Atkinson, Escobar, & Wilson, 2002). The Passage Comprehension subtest requires students to complete a variety of tasks such as identifying a picture that relates to a given object and using their understanding of text to generate an appropriate word for fill-in-the-blank activities. In a sample of 8-10 year olds, this subtest had a one-year test-retest reliability of .88.

Control Variables

Control variables for this study included household income, maternal education, gender, and age. Parents reported highest level of maternal educational attainment at the first wave of data collection by selecting from four possible responses (1=less than high school, 2=high school graduate or GED, 3=some college, 4=B.A./B.S. or higher degree). In addition, parents reported household income at the first wave of data collection on a 3-point scale (1=less than $25,000; 2=$25,000-$50,000; 3=more than $50,000). Child gender and age at the first wave of data collection were used in the analyses.

Analytic Techniques

The statistical analysis technique that was used to analyze the data for this study, latent growth modeling (LGM), falls within the broad family of structural equation modeling (SEM). LGM allows the researcher to model change over time and is therefore aligned with the purpose of this study, which is to describe and predict change in the reading achievement of struggling readers with disabilities. The LGM for this study has a mean structure and was analyzed with LISREL 8.80 (Jöreskog & Sörbom, 2006).

An advantage of the LGM with a mean structure is that it allows the researcher to estimate characteristics of the group (using factor means), as well as characteristics of the individual (using variances). This characteristic is unique to this statistical technique (Duncan & Duncan, 2004). Since this study was concerned with testing how predictors influence the developmental trajectory of particular individuals, both levels of information were necessary. Further, as noted by Kline, when investigating change over time, models with mean structures are preferable to models using covariance as the primary data source. Since the mean scores on repeated measures are likely to change over time, valuable information is lost by not including mean structures in longitudinal models (Kline, 2005).

Data Preparation

According to Kline (2005), there are two types of data that can be used in structural equation modeling, raw data or a covariance matrix summary of data. When analyzing data with many cases and variables, one might choose to use a covariance matrix summary for the analysis because it requires a much smaller data file and may be more user-friendly. On the other hand, raw data must be used if data are non-normal and transformation is used to create a normal distribution or if missing data are estimated using statistical techniques (Kline, 2005). Raw data were used for this study because missing data were addressed using full-information maximum likelihood estimation (FIML), which is discussed in further later in this chapter. Prior to conducting any analyses, data were screened to check several issues relevant to SEM that are described below.

Sample size. In order to conduct SEM, a sample size greater than 50 + 8m, where m=the number of predictor variables, is adequate (Tabachnick & Fidell, 2006). Given that 10 predictors were investigated in this study, the sample size (n=3166) far exceeds the minimum sample size needed (n=130).

Multicollinearity and singularity. It is problematic if two or more predictors in a multivariate analysis are highly correlated because it may limit the degree to which valid interpretations can be drawn regarding the predictive power of any one variable (Kline, 2005). According to Tabachnick and Fidell (2006), a correlation greater than 0.85 is considered an indicator of multicollinearity. Correlations between all predictors are displayed in Table 4. Tabachnick and Fidell’s recommendations served as guidelines to check for multicollinearity for the variables in this study. They recommend inspecting the correlation matrix before beginning analysis, as well as the tolerance values to determine if they are less than .10, which is indicative of multicollinearity.

Outliers. Univariate outliers are large standardized residuals. Values above 3.29 or below -3.29 may be considered outliers (Tabachnick & Fidell, 2006). Univariate outliers were checked using descriptive statistics such as the 5% trimmed mean and the extreme values indicated by the LISREL program, as well as plots (histogram, box plot). Multivariate outliers are cases with an atypical cluster of residuals (Tabachnick & Fidell, 2006). These were checked using Mahalonobonis Distance. A significant result ($p<.001$) indicates multivariate outliers.

Normality. An assumption of SEM is that all variables in the model, as well as all linear combinations of the variable are normally distributed (Tabachnick & Fidell, 2006). Skewness, kurtosis, and residual scatter were used to assess normality.

Linearity and homoscedasticity. Linearity and homoscedasticity were evaluated using the residual scatter plots. Linearity indicates that the dependent variable scores are linearly related to the predictors (Tabachnick & Fidell, 2006), and is an assumption of SEM. Homescadcity is the assumption that the variance of the residuals surrounding the dependent variables should be approximately the same for all predictors (Tabachnick & Fidell, 2006).

Relative variances. SEM requires that the covariances between variables are similar. Therefore, this was evaluated by examining the ratio between the largest and the smallest variances; a ratio greater than 10 indicates an ill-scaled matrix (Kline, 2005). Covariances did not vary greatly and thus there was no reason to rescale variables.

Missing data. Missing data are almost always an issue in longitudinal studies (Newman, 2003) and therefore how to address this problem was carefully considered. Failure to appropriately address missing data in longitudinal research can substantially reduce sample size and compromise the accuracy of parameter estimates (Newman, 2003). Table 5 presents the proportion of missing data for each of the hypothesized predictors and Table 6 presents the proportion of missing data for reading achievement across the three waves of data. Unless the amount of missing data is so small as to have no effect on parameter estimation, classic procedures for addressing missing data such as listwise or pairwise deletion and mean substitution are insufficient for analysis of structural equation models (Mueller & Hancock, 2010). Full-information maximum likelihood (FIML) was used to handle missing data in this study, a method that has been highly recommended for researchers analyzing incomplete data using structural equation modeling (Arbuckle, 1999). FIML is a direct approach for handing missing data. Direct approaches derive parameters directly from the raw data, which allows for retention of all cases in the analysis (Enders & Bandalos, 2001). Further, this technique is ideal for dealing with missing data for the majority of SEM analyses when data are approximately normally distributed and values are missing at random (Duncan, Duncan, & Li, 1998; Toit & Mels, 2002).

Estimation

In accordance with Kline's (2005) recommendations, the latent growth model was tested in two steps in order to more easily identify sources of potential estimation problems. The first step involved modeling change in reading whereas the second step involved predicting change over time. Estimation and determination of the fit of both the change model and the prediction model involved the same considerations; therefore, these are outlined first. The section concludes by describing the change model followed by the prediction model in more detail.

The SEELS data were collected using a stratified cluster sample in order to obtain a nationally representative sample of the population of students with disabilities. Without accounting for this sampling design, design effects may occur that decrease the accuracy of estimates. To account for this design, weighted standard errors can be computed (SRI, 1999). Weighted standard errors can be calculated in LISREL 8.0 with sample design information, which was provided in the SEELS dataset via cluster, strata, and weight variables. Cluster and strata variables provided in the SEELS dataset are applicable to all data collection instruments; however, the weight variable, which accounts for unequal sampling probability, differs across instruments. Since data for this study were drawn from three instruments (i.e., student direct assessment, parent interview, and teacher survey), it was necessary to determine which weight variable would be most appropriate for analyses. Given that the focus of this study is on student reading achievement, the weight from the student direct assessment was used. Therefore, all analyses took into account the sample design by employing the stratum, cluster, and direct assessment weights, which allowed for more accurate calculation of standard errors.

Model fit was tested using LISREL 8.80 (Jöreskog & Sörbom, 2006) statistical software. Several indicators informed evaluation of the adequacy of model fit. These include the value of the standard errors and correlations of the parameter estimates, total variance accounted for by the model goodness of fit, analysis of residuals and model modification indices. Further, the standardized discrepancies and the fitted correlations confined by the model were considered to assess the adequacy of the model since these discrepancies provide valuable information beyond that provided by the fit indices (McDonald & Ho, 2002).

Kline (2005) recommends using the following indices to assess goodness of fit of hypothesized models: Root Mean Squared Error of Approximation (RMSEA), Chi-square, Goodness of Fit Index, Comparative Fit Index, and the Standardized Root Mean Square Residual. Since the Goodness of Fit Index, Comparative Fit Index, and Standardized Root Mean Square Residual cannot be obtained using LISREL 8.80 when the full-information maximum likelihood procedure is used to estimate missing data (Jöreskog & Sörbom, 1996; Jöreskog, 2004), model fit was assessed using the RMSEA and Chi-square fit indices. A non-significant chi-square value indicates adequate model fit (Kline, 2005). RMSEA values less than .05 indicate good fit, values greater than .05 and less than .08 indicate reasonable fit, values between .08 and .10 indicate mediocre fit, and values greater than .10 indicate poor fit (Browne & Cudeck, 1993; MacCallum, Browne, & Sugawara, 1996). In addition, the degree to which the Q plot of the standardized residuals constituted a diagonal line was evaluated. Since adequate model fit was achieved, it was not necessary to conduct a specification search with an eye toward model modification.

Modeling change. Reading achievement at each wave was depicted in this model as an indicator of two latent growth factors, intercept and slope. The intercept factor indicated initial reading achievement (at wave 1) and served a similar function to the intercept in regression. The slope factor represented linear change in reading achievement. Since data were only available at three time points, the unconditional growth model (i.e., change model) analyzed was linear.

All paths between the intercept factor and the outcome variable (i.e., reading achievement) were fixed to 1. This procedure controlled for variability in initial reading achievement across students in the sample. Consistent with other research conducted analyzing latent growth curve models using academic achievement data from the SEELS dataset (e.g., Barnard-Brak, Sulak, & Fearon, 2010), the slope loadings were fixed to 0, 2, and 4 for reading achievement at time point 1, 2, and 3, respectively. As noted by Barnard and colleagues, the slope loadings correspond to the approximate intervals at which data were collected across the four-year duration of the study, which allows the slope to be interpreted as change per year.

The means of the intercept and slope factors in this model are free parameters. The mean of the intercept factor indicates the average reading achievement of the whole sample of students at wave 1 (adjusted for measurement error). The variance of the intercept factor indicates the amount of variation there was in the reading achievement of individual students at wave 1. The mean of the slope factor indicates the average rate of change in reading achievement each year of the whole sample of students. The variance of the slope factor indicates the amount of variation there was in individual students' rate of growth in reading achievement each year. The change model allows the intercept and slope factors to co-vary.

Predicting change. Since the model of change in reading achievement over time adequately fit the data, the next step was to test conditional growth models (i.e., models predicting change in reading achievement). Thus, predictors were added to the model to determine the degree to which they explained variation in rate of growth amongst individuals in the sample. The predictors are assumed to have direct effects on the intercept and slope factors. Consequently, the intercept and slope factors become endogenous in this model (they were exogenous in the change model). Endogenous variables are those for which the model specifies causes. According to Kline (2005), every endogenous variable must have a disturbance associated with it. Disturbances estimate the variance in a particular endogenous variable that is unexplained by the variables specified as its causes in the model. In addition, the disturbances in the prediction model are assumed to co-vary. Therefore, the model assumes that initial status (reading achievement at wave 1) and linear change over time have common causes that are excluded from the model; that is, these factors are not solely caused by any of the predictors in the model.

CHAPTER 4

RESULTS

This chapter begins with a description of demographic characteristics of the sample. As described in the previous chapter, analyses for this study were conducted in two stages. Therefore, the next section of this chapter describes results of the first analysis stage (i.e., unconditional growth model). The chapter concludes with results of the second analysis stage (i.e., conditional growth models).

Descriptive Statistics

Demographic characteristics of the sample are displayed in Table 7. The sample was 66% male with ages ranging from 8 to 12 years at the beginning of the study. Student ethnicity was Caucasian (72%), African American (17%), Hispanic (9%), Asian/Pacific Islander (1%), American Indian/Alaska Native (1%), and Multiple/other ethnicities (<1%). The sample included students with each of the twelve federal disability categories; however, the largest proportion of the population had learning disabilities (13%) or other health impairments (13%). Reading achievement scores across disability status are presented in Table 8.

Modeling Change in Reading Achievement across Time: Unconditional Growth Model

Since reasonable model fit is needed to obtain trustworthy parameter estimates, the goodness of fit of the unconditional growth model was assessed first.[1] Next the parameter estimates were investigated. Of particular interest was the variance of the intercept and slope factors, as significant variance of the intercept and slope factors are indicative of individual differences in initial status and growth rate, respectively. Significant variance of either the

---

[1] Assessment of fit was limited to the Chi-square and RMSEA fit indices since the NFI, NNFI, CFI, IFI, and GFI cannot be calculated by LISREL when the FIML procedure is used (Jöreskog & Sörbom, 1996; Jöreskog, 2004).

intercept or slope factors indicates that predictors should be added to the model to determine the degree to which they account for variance. On the other hand, non-significant variance of the intercept and slope factors indicates that adding predictors to the model is unnecessary because individual differences in initial status and growth rate are not substantial. Results are described by outcome variable.

Reading Fluency

The first column in Table 9 displays the results of fitting the unconditional growth model for the reading fluency outcome. A Chi-square value of 9.91 ($p=.002$) was obtained for the unconditional reading fluency growth model, which indicates that the model misfit differs significantly from 0 (i.e., the hypothesized fluency growth model differs significantly from a perfectly fitted model). However, the Chi-square value is affected by sample size. Specifically, if the sample size is large, the value of the Chi-square may lead to rejection of the model even though differences between observed and predicted covariances are slight (Kline, 2005). An RMSEA of 0.05 was obtained, which suggests reasonable fit, according to recommendations of Browne and Cudeck (1993) and MacCallum, Browne and Sugawara (1996). Given the large sample size of this study ($n=3166$), and because the RMSEA value suggested reasonable model fit, the unconditional fluency growth model was retained.

The mean of the intercept factor was 79.44 ($SE=1.98$), $p<0.001$, which indicates a mean oral reading fluency rate of 79.44 words per minute at the initial time point. The slope factor mean was 9.35 ($SE=0.28$), $p<0.001$. Thus, the average increase in reading rate was 9.35 words per minute each year. Variance of the intercept factor was 2360.04 ($SE=108.59$), $p<0.001$ and variance of the slope factor was 37.24 ($SE = 9.09$), $p<0.001$. Therefore, there was significant variability in both initial status and rate of growth. In addition, the low standard error for each parameter suggests that each estimate is relatively stable.

Reading Comprehension

The first column in Table 10 presents the results of fitting the unconditional growth model for the reading comprehension outcome. A Chi-square value of 0.38 ($p=0.54$) was obtained, which indicates that the model, which indicates that the hypothesized comprehension growth model does not differ significantly from a perfectly fitted model. In addition, the RMSEA value obtained was 0.00, indicating good model fit. The mean of the intercept factor was 483.04 (SE=0.80), $p<0.001$. The mean of the slope factor was 3.32 (SE=0.16), $p<0.001$. Variance of the intercept and slope factors was 433.05 (SE=31.55), $p<0.001$ and 10.70 (SE=2.43), $p<0.001$, respectively. Therefore, significant variability existed in both initial reading comprehension and rate of growth.

Given the significant variance of the intercept and slope factors for both outcome variables, the next step was to add the hypothesized predictors to the model to determine the degree to which they explained differences in initial status and rate of growth. Control variables (age, gender, household income, and maternal education) were added to the model last to determine whether effects of the predictors stayed the same and remained significant. Results of these analyses are described in the following sections as they pertain to each research question addressed by this study.

Research Question 1: Conditional Growth Model for Child-Instruction Interaction

The degree to which child-instruction interaction predicted the reading achievement of elementary school students with disabilities who struggle with reading was explored to address the first research question. Child-instruction interaction (range: from 1=low to 3=high) was added to the unconditional growth model. Next, control variables were added to the model to assess how they influenced the prediction of reading achievement. Results are described in the following sections and are organized by reading outcome. All parameter estimates are displayed in Tables 11 and 12 for reading fluency and comprehension, respectively. As described in Chapter 3, wave 2 data were used to compute the child-instruction interaction variable. Therefore, this variable's impact on student achievement was only explored for the slope factor mean not the intercept factor mean.

Child-Instruction Interaction

Reading fluency. It was hypothesized that child-instruction interaction would positively predict reading fluency growth. The relationship between child-instruction interaction and the mean of the slope factor was 0.99 (SE=0.36), $p<0.01$. Therefore, students who received instruction more aligned with their reading skills exhibited greater annual growth than students who received instruction less aligned with their reading skills. Unexplained individual variance in annual reading fluency change decreased from 37.24 to 4.43. Thus, child-instruction interaction explained approximately 88% of the individual differences in rate of growth in reading fluency.

Reading comprehension. As was hypothesized for fluency, it was expected that child-instruction interaction would positively predict rate of reading comprehension growth. The relationship between child-instruction interaction and the slope factor mean was 0.59 (SE=0.21), $p<.01$. Therefore, students who received language arts instruction that was more aligned with their reading skills demonstrated greater rates of annual growth than students who received language arts instruction that was less aligned with their reading skills. Variance of the slope factor decreased from 10.70 to 5.05, indicating that child-instruction interaction accounted for approximately 53% of the individual differences in rate of growth in reading comprehension.

Control Variables

Reading fluency. Several significant relationships were obtained between the control variables and the latent factors. Age, gender, maternal education, and household income positively predict the intercept factor mean. In addition, age was negatively associated with the slope factor mean.

The relationship between child-instruction interaction and the slope factor mean was 0.89 (SE=0.32), p<.01. Therefore, after accounting for the variance explained by the control variables, child-instruction interaction remained a significant predictor of rate of reading fluency growth. Students who received instruction more aligned with their reading skill demonstrated greater annual reading growth than those who received instruction less aligned with their reading skill. Table 11 presents effect-size correlations for the estimates obtained in order to gauge size of effects (O'Brien & Peyton, 2002)[2] of child-instruction interaction and demographic characteristics. The effect of 0.20 indicates a small effect (Cohen, 1988) of child-instruction interaction on growth rate.

Reading comprehension. The relationship between child-instruction interaction and the slope factor mean was 0.53 (SE=0.22), p<.05. Therefore, after accounting for the variance explained by the control variables, child-instruction interaction remained a significant predictor of reading growth. Students who received instruction more aligned with their reading skill demonstrated greater annual reading growth than those who received instruction less aligned

---

[2] Effect size correlations were computed using the default procedure in LISREL, which according to Jöreskog and Sörbom (2001) invokes the following formula: $r_{effect} = (t^2/(t^2 + df))^{1/2}$

with their reading skill. Table 12 presents effect-sizes of the estimates obtained for the reading comprehension outcome. The effect of 0.40 indicates that child-instruction interaction has a medium sized effect on rate of reading comprehension growth.

Research Question 2: Conditional Growth Model for Teacher Quality

Next, the degree to which teacher quality, as measured by teacher professional development, experience, and education, predicted reading achievement over time for elementary school students with disabilities who struggle with reading was investigated. First, teacher professional development (0=no; 1=yes) was added to the unconditional growth model, followed by teacher experience (range=0-47 years), and education (range=1-7; 1=high school diploma, 7=doctoral degree). Teacher professional development was added to the model first because its focus was on effective reading/literacy instruction, which is of particular interest in this study. Teacher experience was added to the model next because more empirical evidence exists for the relationship between teacher experience and student achievement than for the relationship between teacher education and student achievement. All parameter estimates are displayed in Tables 13 and 14 for reading fluency and comprehension, respectively.

Teacher Professional Development

Reading fluency. It was hypothesized that teacher professional development would positively predict reading fluency growth. The association between teacher professional development and the intercept factor mean was 9.99 (SE=3.37), $p<.01$, indicating that initial reading fluency was approximately 10 words per minute higher for students whose teachers had participated in at least 8 hours of professional development in language arts, English, or writing during the past three years. Variance among student reading fluency intercepts changed from 2360.04 to 2103.44. Therefore, teacher professional development accounted for approximately

11% of the individual differences in initial reading fluency. However, despite the finding that teacher professional development predicted initial reading fluency, the hypothesis that it would predict rate of growth was not supported. There was a non-significant relationship obtained between teacher professional development and the slope factor mean.

Reading comprehension. As was hypothesized for fluency, it was expected that teacher professional development would positively predict rate of reading comprehension growth. The relationship between teacher professional development and the intercept factor mean was 3.55 (SE=1.59), $p<.05$. This finding suggests that students whose teachers had participated in at least 8 hours of professional development in language arts, English, or writing during the past three years demonstrated higher initial reading comprehension. Variance of the intercepts decreased from 433.05 to 304.38, suggesting that teacher professional development explained approximately 30% of the individual differences in initial reading comprehension. Although teacher professional development predicted initial reading comprehension, the hypothesis that it would predict rate of growth was not supported. There was a non-significant relationship between teacher professional development and the slope factor mean.

Teacher Experience

Reading fluency. Next teacher experience was added to the model to test the hypothesis that teacher experience would positively predict rate of growth. The relationship between teacher experience and the intercept factor mean was non-significant; however, teacher experience positively predicted rate of growth. The association between teacher experience and the slope factor mean was 0.06 (SE=0.03), $p<.05$. Therefore, students with more experienced teachers demonstrated higher rates of fluency growth than those with less experienced teachers. Variance of the slope factor decreased from 6.59 to 5.90, indicating that teacher experience accounted for approximately 10% of the individual differences in rate of growth.

Reading comprehension. As was hypothesized for fluency, it was expected that teacher experience would be positively related to reading comprehension growth. However, teacher experience did not predict rate of growth, as evidenced by the non-significant relationship between the slope factor mean and teacher experience. Similarly, the relationship between teacher experience and the intercept factor mean was non-significant.

Teacher Education

Reading fluency. It was hypothesized that teacher education would positively predict rate of reading fluency growth. Yet, teacher education did not predict rate of growth, as evidenced by the non-significant association between the slope factor mean and teacher education. Similarly, the relationship between teacher education and the intercept factor mean was non-significant.

Reading comprehension. As was hypothesized for fluency, it was expected that teacher education would be positively associated with reading growth. However, the association between teacher education and the slope factor mean was non-significant, refuting this hypothesis. Furthermore, the relationship between teacher education and the intercept factor mean was non-significant.

Control Variables

Reading fluency. Control variables were added to explore whether the nature or significance of relationships previously found changed. Several significant relationships were obtained between the control variables and the latent factors. Positive associations were found between the intercept factor mean and age, gender, maternal education, and income. Further, age was negatively related to the slope factor mean.

The relationship between teacher professional development and the intercept factor mean was 9.93 (SE=2.84), $p<.001$. As found previously, teacher professional development was positively associated with initial status. However, the hypothesized relationship between teacher experience and rate of growth that was found previously was no longer obtained once the control variables were added. Table 15 presents effect-size correlations for the estimates obtained once control variables were added to the model in order to provide an estimate of the size of the effects of teacher qualifications and demographic characteristics. The effect of 0.09 indicates a small effect of teacher professional development on initial reading fluency. Finally, the relationship between teacher experience and the slope factor mean was non-significant.

Reading comprehension. Control variables were added to explore whether the relationship between teacher professional development and initial status previously found remained significant. Age, maternal education, and household income were positively associated with the intercept factor mean. Further, age was negatively related to the slope factor mean.

The relationship between teacher professional development and the intercept factor mean was 3.85 (SE=1.53), $p<.05$. Therefore, after accounting for the variance explained by the control variables, teacher professional development remained a significant, positive predictor of initial reading comprehension. Table 16 presents effect-size correlations for the estimates. The effect of 0.09 indicates that as was found for the reading fluency outcome, the size of the effect of teacher professional development on initial comprehension is small.

Research Question 3: Conditional Growth Model for Instructional Group Size

The relationship between two instructional group sizes (small group, individual instruction) and the reading achievement of students receiving special education services who struggle with reading was investigated to address the third research question. Both group size variables ranged from 1 to 4 (1 = never; 4 = often). A similar approach was taken to address this question to that employed to investigate the first two research questions. First frequency of small group instruction was added to the unconditional growth model. Next, frequency of individual instruction was added to the model to determine the relative influence of these predictors on reading achievement. Given that teachers likely have less difficulty implementing small group instruction as compared to individual instruction in schools, small group instruction was added to the model first. Finally control variables were added to the model to assess how they influenced the prediction of reading achievement. Results are described in the following sections and are organized by reading outcome. All parameter estimates are displayed in Tables 17 and 18 for reading fluency and comprehension, respectively.

Small Group Instruction

Reading fluency. It was hypothesized that frequency of small group instruction would positively predict rate of reading fluency growth. The relationship between small group instruction and the intercept factor was -23.82 (SE=2.15), p<.001, which indicates that students who received more frequent small group instruction demonstrated lower initial fluency than students who received less frequent small group instruction. Variance of the intercept factor decreased from 2360.04 to 1883.92 once small group instruction was added to the unconditional growth model. Therefore, it was estimated that small group instruction accounted for approximately 20% of the individual differences in initial reading fluency.[3] Although small

[3] As calculated: (2360.04-1883.92)/2360.04=.20

group instruction predicted initial reading fluency, the hypothesis that it would predict rate of growth was not supported. There was a non-significant relationship obtained between small group instruction and the slope factor mean.

Reading comprehension. As was hypothesized for fluency, it was expected that frequency of small group instruction would positively predict rate of reading comprehension growth. The relationship between small group instruction and the intercept factor was -8.46 (0.89), $p<.001$, suggesting that students who received more frequent small group instruction demonstrated lower initial reading comprehension than other students. Variance of the intercept decreased from 433.05 to 283.46, suggesting that small group instruction explained approximately 35% of individual differences in initial status. As hypothesized, small group instruction also predicted rate of growth. The relationship between small group instruction and the slope factor mean was 0.73 (SE=0.21), $p<.001$, indicating that students who received more frequent small group instruction demonstrated higher annual growth rates than did students who received less frequent small group instruction. Variance of the slope factor decreased from 10.70 to 3.72, indicating that frequency of small group instruction explained approximately 65% of the individual differences in rate of reading comprehension growth.

Individual Instruction

Reading fluency. Next, frequency of individual instruction was added to the model to test the hypothesis that frequency of individual instruction would positively predict rate of reading growth. The relationship between individual instruction and the intercept factor mean was -15.99 (SE=2.25), $p<.001$, indicating that frequency of individual instruction negatively predicted initial status. As compared to the previous model, the variance of the intercept factor declined from 1883.92 to 1757.06, which indicates that individual instruction explained approximately 7% of the individual differences in initial reading fluency. Contrary to the hypothesis that frequency of individual instruction would predict annual reading fluency growth, the relationship between the slope factor mean and individual instruction was non-significant.

Reading comprehension. As was hypothesized for fluency, it was expected that individual instruction would positively predict rate of reading comprehension growth. An association of -6.34 (SE=0.90), $p<.001$ was found between individual instruction and the intercept factor mean, indicating that students who received more frequent individual instruction demonstrated lower initial reading comprehension than students who received less frequent individual instruction. Variance among students' initial reading comprehension declined from 283.46 to 264.36, indicating that individual instruction accounted for approximately 7% of individual differences in initial reading comprehension. The relationship between individual instruction and the slope factor mean was non-significant. Thus, the hypothesis that frequency of individual instruction would positively predict rate of reading comprehension growth was not supported.

Control Variables

Reading fluency. Control variables were added to the model to explore whether the nature or significance of relationships previously found changed. Several significant relationships were obtained between the control variables and the latent factors. Positive associations were found between the intercept factor mean and age, gender, maternal education, and income. In addition, age was negatively related to the slope factor mean.

The relationship between small group instruction and the intercept factor mean was -12.71 (SE=2.06), $p<.001$. Therefore, after accounting for the variance explained by the control variables, small group instruction remained a significant, negative predictor of initial reading fluency. Table 19 presents an effect-size correlation of 0.18 for small group instruction, which indicates that the magnitude of its effect on initial reading fluency is small. In addition, consistent with prior findings obtained in this study, the relationship between small group instruction and the slope factor mean was non-significant.

The relationship between individual instruction and the intercept factor mean was -14.70 (SE=1.95), p<.001. Therefore, after accounting for the variance explained by the control variables, individual instruction still negatively predicted initial status. As can be seen in Table 19, the effect of 0.23 for individual instruction indicates that the size of its effect on initial reading fluency is small. As was found in the previous model, no significant relationship was obtained between individual instruction and the slope factor mean.

Reading comprehension. Several significant relationships were found when control variables were added to the model. Positive associations were found between the intercept factor mean and age, maternal education, and household income. In addition, age was negatively associated with the slope factor mean.

The association between small group instruction and the intercept factor mean was -3.74 (SE=0.89), p<.001. Therefore, after accounting for the variance explained by the control variables, small group instruction remained a significant, negative predictor of initial reading comprehension. Table 20 presents the effect of 0.14 for small group instruction, which indicates that the magnitude of its effect on initial reading comprehension is small. In addition, the relationship between small group instruction and the slope factor mean was non-significant. Therefore, after accounting for the variance explained by the control variables, the relationship between small group instruction and rate of growth was no longer significant.

Relationships found between individual instruction and the latent factors were similar to those found in previous analyses. The relationship between individual instruction and the intercept factor mean was -5.91 (SE=0.85), $p<.001$. Therefore, after accounting for the variance explained by the control variables, individual instruction remained a significant, negative predictor of initial reading comprehension. As can be seen in Table 20, the effect of 0.23 for individual instruction indicates that the size of its effect on initial reading comprehension is small. In addition, as was found in the prior model, no significant relationship was obtained between individual instruction and the slope factor mean, indicating that frequency of individual instruction does not predict annual reading comprehension growth.

Research Question 4: Impact of each type of Predictor on Reading

Given the strong relationship found between child-instruction interaction and reading growth, this effect relative to the other main predictors (i.e., instructional group size and teacher qualifications) was examined. Thus, one of each type of predictor were added to the model to examine whether the effect of child-instruction interaction stayed the same and remained significant. First, the child-instruction variable was added to the unconditional growth model because it was determined that alignment between student skill level and the focus of instruction is essential for effective learning to occur. Frequency of small group instruction was added to the model next followed by teacher professional development because the link between small group instruction and student achievement has been consistently demonstrated empirically, whereas, the relationship between teacher qualification variables and student achievement has been demonstrated less consistently. Finally, control variables were added to the model to assess how these covariates influenced the prediction of reading achievement.

Results are described in the sections that follow. Since the results obtained when child-instruction interaction was added to the unconditional growth model were already described as they pertained to the third research question, the following sections begin with a description of the results obtained once small group instruction was added to the child-instruction interaction model. Results are organized by reading outcome. All parameter estimates are displayed in Tables 21 and 22 for reading fluency and comprehension, respectively.

Small Group Instruction

Reading fluency. After controlling for child-instruction interaction, the relationship between small group instruction and the intercept factor was -23.68 (SE=2.14), $p<.001$, which indicates that students who received more frequent small group instruction exhibited lower initial status than students who received less frequent small group instruction. As compared to the child-instruction interaction model, variance of the intercept factor decreased from 2099.66 to 1866.39. Thus, frequency of small group instruction accounted for approximately 11% of the individual differences in initial reading fluency. Variance in linear slope increased from 4.43 to 6.42. Thus, frequency of small group instruction accounted for none of the individual differences in rate of reading fluency growth. The association between small group instruction and the slope factor mean was 0.86 (SE=0.41), $p<.05$, suggesting that after controlling for child-instruction interaction, students who received more frequent small group instruction demonstrated higher rates of annual growth in reading fluency than students who received less frequent small group instruction.

Reading comprehension. The association between small group instruction and the mean of the intercept factor was -8.30 (SE=0.88), $p<.001$, suggesting that after controlling for child-instruction interaction, students who received more frequent instruction in small groups demonstrated lower initial reading comprehension than students who received less frequent instruction in small groups. Variance of the intercept factor decreased from 301.67 to 280.16. Therefore, frequency of small group instruction explained approximately 7% of the individual differences in initial reading comprehension. The relationship between small group instruction and the mean slope factor was 0.84 (SE=0.22), $p<.001$. Therefore, students who received more frequent small group instruction demonstrated greater annual comprehension growth rates than students who received less frequent small group instruction. Variance in linear slope decreased from 5.05 to 4.23 once small group instruction was added to the model. Thus, small group instruction explained approximately 16% of the individual differences in rate of reading comprehension growth.

Professional Development

Reading fluency. The association between teacher professional development and the mean intercept factor was 10.18 (SE=3.02), $p<.001$, indicating that students whose teachers reported having completed professional development in literacy over the past three years demonstrated initial reading fluency approximately 10 words per minute higher than that exhibited by students whose teachers did not report completing this professional development. Variance of the intercept factor decreased slightly from 1866.39 to 1847.51, suggesting that teacher professional development explained approximately 1% of the individual differences in initial reading fluency. No significant relationship was found between teacher professional development and the slope factor mean.

Reading comprehension. The relationship between teacher professional development and the mean intercept factor was 3.61 (SE=1.52), $p<0.05$, which indicates that students whose teachers had completed professional development exhibited higher initial reading comprehension than students who had teachers who had not completed professional development. Variance of the intercept factor decreased slightly from 280.16 to 278.26. Thus, teacher professional development explained approximately 3% of the individual differences in initial reading comprehension. No significant relationship was found between teacher professional development and the slope factor mean.

Control Variables

Reading fluency. Control variables were added to the model to investigate whether the significance or size of relationships previously found changed. Several significant relationships were obtained between the control variables and the latent factor means. Positive associations were found between the intercept factor mean and age, gender, maternal education, and income. In addition, age was negatively associated with the slope factor mean.

The association between child-instruction interaction and the slope factor mean was 0.87 (SE=0.33), p<.01. Therefore, after accounting for the variance explained by the control variables, child-instruction interaction remained a significant, positive predictor of reading fluency growth. Table 23 presents an effect-size correlation of 0.07 for child-instruction interaction, which indicates that the magnitude of its effect on rate of growth is small.

The relationship between small group instruction and the intercept factor mean was -17.79 (SE=2.27), p<.001. Therefore, after accounting for the variance explained by the control variables, small group instruction still negatively predicted initial status. As can be seen in Table 23, the effect of 0.15 for small group instruction indicates that the size of its effect on initial reading fluency is small. Contrary to the previous model, no significant relationship was obtained between small group instruction and the slope factor mean. Therefore, after accounting for the variance explained by the control variables, small group instruction no longer predicted rate of growth.

The association between teacher professional development and the intercept factor mean was 9.77 (SE=2.71), $p<.001$. Thus, after accounting for the variance explained by the control variables, teacher professional development remained a significant, positive predictor of initial reading fluency. Table 23 presents an effect-size correlation of 0.04 for teacher professional development, which indicates that the magnitude of its effect on initial reading fluency is small. Further, consistent with prior findings obtained in this study, the relationship between teacher professional development and the slope factor mean was non-significant.

Reading comprehension. As was found for the fluency outcome, several significant relationships were obtained between the control variables and the latent factor means for the comprehension outcome. Positive associations were found between the intercept factor mean and age, maternal education, and household income. In addition, age and household income were negatively associated with the slope factor mean.

The association between child-instruction interaction and the slope factor mean was 0.49 (SE=0.22), $p<.05$. Therefore, after accounting for the variance explained by the control variables, child-instruction interaction remained a significant, positive predictor of rate of reading comprehension growth. Table 24 presents the effect of 0.07 for child-instruction interaction, which indicates that the magnitude of its effect on rate of reading comprehension growth is small.

Relationships between small group instruction and the latent factors were similar to those found in previous models. The association between small group instruction and the intercept factor mean was -5.68 (SE=0.92), $p<.001$. Therefore, after accounting for the variance explained by the control variables, small group instruction remained a significant, negative predictor of initial reading comprehension. As can be see in Table 24, the effect of 0.12 for small group instruction indicates that the size of its effect on initial reading comprehension is small. In addition, the relationship between small group instruction and the slope factor mean was 0.51 (SE=0.22). $p<.01$. Thus, after accounting for the variance explained by the control variables, small group instruction remained a significant, positive predictor of reading comprehension growth. Table 24 shows the effect of 0.07 for small group instruction, which indicates that the magnitude of its effect on reading comprehension growth is small.

Associations found between teacher professional development and the latent factors were also similar to those found in the previous model analyzed in this study. The relationship between teacher professional development and the intercept factor mean was 3.82 (SE=1.54), $p<.05$. Therefore, after accounting for the variance explained by the control variables, teacher professional development remained a significant, positive predictor of initial reading comprehension. As can be seen in Table 24, the effect of 0.04 for teacher professional development indicates that the size of its effect on initial reading comprehension is small. In addition, as was found in the prior model, no significant relationship was obtained between teacher professional development and the slope factor mean, indicating that teacher professional development does not predict annual reading comprehension growth.

CHAPTER 5

DISCUSSION

Although researchers have long debated whether reading instruction should focus on word-based or meaning-based reading approaches (Rayner et al., 2001), more recent evidence from studies of early elementary students in general education has suggested that the amount of time teachers devote to either word-level or meaning-based activities should depend on students' skill levels (Hatcher et al., 2004; Foorman et al., 2003; Connor et al., 20004; Juel & Minden-Cupp, 2000). Researchers have referred to this instructional approach as *child-instruction interaction* (Connor, Morrison, & Katch, 2004).

The principal goal of this study was to explore the degree to which the relationship between child-instruction interaction and reading growth, which has been found for early elementary students in general education, applies to older elementary students in special education. Several hypothesized predictors of reading growth were examined in this study. Individual and small group instruction were selected for inclusion in this study because evidence suggests that they may increase the reading growth demonstrated by students with disabilities (Elbaum et al., 1999; Torgesen, 2004). Despite the uncertain relationship between teacher qualifications and student achievement (e.g. Hanuschek, 1981, 1986, 1989, 1997), it was also examined in this study because it has become the focus of increasing consideration within recent educational policy (e.g., No Child Left Behind; see DOE, 2004a, 2004b).

This chapter summarizes findings related to the relative influence of hypothesized predictors on the reading growth of upper elementary school students receiving special education services who struggle with reading. In addition to providing an overview of these findings, implications of results for theory, research, and practice are discussed. Finally, the chapter concludes with a description of limitations of the study.

Summary of Findings

To describe and predict the reading growth of elementary school students receiving special education services who struggle with reading, a latent growth model was tested in two steps. First, change in reading achievement across time was modeled. Next, change in reading achievement over time was predicted. Since reasonable model fit is needed to obtain trustworthy parameter estimates, the goodness-of-fit of the hypothesized unconditional growth model was assessed first. Goodness-of-fit indices suggested reasonable fit of the hypothesized unconditional growth model for both reading outcomes. Thus, it was determined that parameter estimates could be trusted and consequently these were interpreted next. The mean of the slope factor was significant; which indicates that students in the sample demonstrated growth on both reading outcomes. Variance of the intercept and slope factors for both reading outcomes were significant, which indicates that individual differences existed in initial status and growth rate, respectively. Given the significant variance of these factors, hypothesized predictors of reading growth were added to the model to determine the degree to which they account for variance.

Child-Instruction Interaction

The central question investigated in this study was whether the relationship between child-instruction interaction and reading growth that has been demonstrated consistently for early elementary school students in general education (e.g., Connor, Morrison, & Katch, 2004; Foorman et al., 1998; Hatcher et al., 2004) would be found for older students receiving special education services who struggle with reading. It was hypothesized that child-instruction interaction would be positively related to rate of growth in reading fluency and comprehension.

Results indicated that child-instruction interaction positively predicted rate of growth for both outcomes, thus supporting the hypothesis. Further, the relationship between child-instruction interaction and rate of reading growth remained significant once control variables (i.e., age, gender, maternal education level, and household income) were added to the model. In addition, when considered relative to other hypothesized predictors (small group instruction, teacher professional development) and descriptive characteristics, child-instruction interaction remained a significant predictor of individual differences in both reading fluency and comprehension growth. Thus, it appeared that child-instruction interaction was a significant predictor of reading growth; students who received instruction highly aligned with their reading skills demonstrated greater rates of annual reading growth than students who received instruction less aligned with their reading skill.

How can these findings be explained? According to the self-teaching hypothesis (Share, 1995; Share & Stanovich, 1995; Torgesen & Hecht, 1996) learning to read involves phonemic awareness, knowledge of some phonics rules, and frequent opportunities to read new words. From this perspective, phonics instruction should provide students with the skills they need to be able to decode text independently. Further, once students have reached this level of competence, they may benefit more from increased opportunities to read independently than they would from phonics instruction alone (Share; Share & Stanovich, 1995; Torgesen & Hecht, 1996). Consequently, teachers who differentiate their instruction according to their students' individual needs are likely to see greater rates of reading growth.

Within the general education population, several studies have obtained findings consistent with the self-teaching hypothesis for early elementary students. Struggling readers demonstrate greater reading growth if they receive instruction heavily focused on direct phonics instruction (Foorman et al., 1998), whereas strong readers demonstrate more growth when they receive instruction with greater emphasis on more meaningful reading experiences and less explicit phonics instruction (Hatcher et al., 2004; Juel & Minden-Cupp, 3000). Connor and colleagues (2004) conducted a longitudinal observational study of first grade students in general education, providing insight regarding the balance of instructional activities that may be most beneficial for students with differing initial skills. The authors coded decoding instruction on several dimensions such as the degree to which it was explicit versus implicit. They found that students with higher initial vocabulary and decoding skills demonstrated greater growth if they received instruction with a greater emphasis on implicit decoding instruction (e.g., silent reading, listening to teacher read etc.). On the other hand, students with lower skills at the beginning of first grade demonstrated more growth by the end of the school year if they received instruction with a greater emphasis on explicit decoding instruction (e.g., direct phonics instruction).

Similarly, in this study, students were coded high child-instruction interaction if they either (a) had poor decoding skills and received language arts instruction more focused on explicit decoding instruction (i.e., phonics) than implicit decoding instruction (i.e., silent reading); or (b) had strong decoding skills and received language arts instruction more focused on implicit than explicit decoding instruction. Thus, the finding that child-instruction interaction positively predicted reading growth is consistent with existing theoretical and empirical evidence. Further, findings of this study build upon previous research by examining the relationship between child-instruction interaction and reading growth in a sample of older students who receive special education services. Findings indicate that students may benefit more when the particular balance of instructional activities they receive are aligned with their skill level. It is important to note, however, that research indicates that regardless of initial skill level, students who receive instruction that is a balance of both phonics and more meaningful reading actitivies demonstrate greater reading gains than students who receive instruction that consists exclusively of one type of instruction (Mathes et al., 2005; Xue & Meisels, 2004). Therefore, the findings of this study do not imply, for example, that poor decoders should solely receive phonics instruction to the exclusion of more meaningful reading activities. Instead, findings suggest that students with varying reading skills should all receive a variety of instructional activities including both direct phonics instruction and more meaningful activities but that reading growth may be optimized when students' initial skill level is taken into consideration when determining the precise blance of instructional time that should be dedicated to phonics versus more meaningful reading activities.

Given the correlational nature of this study, it is not clear whether the relationship between child-instruction interaction and reading growth is causal. Thus, experimental and quasi-experimental studies are needed to evaluate the effectiveness of child-instruction interaction for increasing the reading growth of upper elementary school students with disabilities who struggle with reading. Although caution is needed in interpreting these findings given that they are correlational, one implication of the finding linking child-instruction interaction and reading growth is that teacher alignment of the balance of instructional activities to student skills may enhance student achievement. Thus, these findings suggest that if teachers seek to increase child-instruction interaction, frequent assessment of student skill will be necessary to inform instructional planning regarding the most appropriate balance of phonics and other, more meaningful reading experiences for each child.

Teacher Quality

In addition to child-instruction interaction, this study considered other hypothesized predictors of student reading growth. This section summarizes the analyses surrounding one such predictor: teacher quality. It was hypothesized that three teacher quality variables -- teacher educational background, years of teaching experience, and amount of professional development -- would positively predict the reading growth of students in the sample. However, non-significant relationships were found between all of the teacher quality variables and student growth on both reading fluency and comprehension. This finding is inconsistent with evidence that teachers have an impact on student achievement (Darling-Hammond, 2000; Darling-Hammond & Youngs, 2002); yet there are several possible explanations for this inconsistency.

One possible interpretation for the difference between findings from this study and those from large-scale studies investigating the link between teacher quality and student achievement are the differences in sample characteristics. Several recent, large-scale general education studies have investigated the link between teacher qualifications and student achievement (Darling-Hammond, 2000; Fenstermacher & Richardson, 2005; Humphrey & Weschler, 2005; National Commission on Excellence in Elementary Teacher Preparation for Reading Instruction, 2003). Although many of these studies included students in both general and special education, the findings are seldom reported separately for these two populations of students. According to Blanton and colleagues (2006), few studies have investigated the relationship between teacher qualifications and student achievement for students receiving special education services. Thus, it may be that the findings of this study indicate that teacher quality does not affect the achievement of students in the special education population as it does students in general education.

An alternative explanation for the findings obtained in this study is that teacher quality does play a role in student reading growth but that the variables used to measure teacher quality (which are similar to those used in several large-scale studies involving teacher quality) do not capture the differences in effectiveness between teachers. According to Cohen and colleagues (2003), the research literature on the effect of school resources – such as teacher quality – on student achievement is full of contradictory findings, a point that is reiterated in meta-analyses by Greenwald, Hedges, and Laine (1996) and Hanushek (1997). Research exploring the effect of teacher quality on student achievement typically involves regressing student achievement on various measures of teacher quality such as education, experience, and professional development. In most cases, these studies lack data on the instructional practices that are likely to interact in important ways with teacher characteristics to impact student achievement. A study conducted by Connor et al. (2009) supported the utility of Cohen's framework; their findings indicated that while neither teacher qualifications (experience, education) nor professional development directly impacted student achievement, professional development exerted an indirect influence on student achievement via instructional practices. Since the current study did not investigate the interrelations among teacher quality and instructional practices, it is not possible to rule out the chance that teacher quality variables may impact student reading growth indirectly. Future research examining these interrelationships may be useful to further examine the nature of relations amongst teacher quality, instructional practices, and student achievement gains.

Although none of the teacher quality variables predicted student reading growth in this study, one of these variables, teacher professional development, predicted students' initial status. After accounting for the influence of demographic characteristics, teacher education, and teacher experience, teacher professional development was a small, positive predictor of individual differences in reading fluency and comprehension at the first wave of data collection. A similar finding was found in the full model, which investigated the effect of different types of predictors relative to one another. Therefore, students whose teachers reported completing at least eight hours of professional development in language arts, English, or writing during the past three years initially outperformed students whose teachers did not complete this professional development.

What could account for this finding? Since the first wave of data was collected several months into the academic year,[4] students had already received a considerable amount of instruction from their teacher by the time reading achievement was assessed. Thus, it is possible that students whose teachers reported completing professional development may have demonstrated higher scores at wave 1 in part because they had received more effective instruction to that point. However, the effect found was also quite small, which could be attributable to the low threshold for counting as having completed professional development (8 hours over 3 years). In a review of existing research on the effect of professional development on student achievement, Yoon and colleagues (2007) reported that in studies where teachers completed a substantial amount of professional development (more than 14 hours in a single year), it had a positive and significant effect on student achievement. In contrast, in studies where teachers received less professional development (5-14 hours total), there were no statistically significant effects on student achievement. Given this study's relatively low cutoff for professional development, even if the variable did have an effect on student achievement, it would not be surprising that this effect would fade over time. Existing research suggests that

[4] Data were collected for wave 1 between February 2001 and May 2001.

unless the teachers receive training throughout the year, it is unlikely that they would continue to incorporate the training into their instruction (Norris, 2001). However, no data are available for student achievement at the beginning of the wave 1 school year to evaluate this possibility; nor is data available regarding the specific components of professional development provided to each teacher. In addition, it is also possible, as with any study in which natural variation is explored, that an unobserved influence on student achievement in the analysis accounted for the finding obtained.

Instructional Group Size

This study also investigated whether individual and small group instruction predicted the reading growth of the students in this sample. It was hypothesized that small group and individual instruction would positively predict reading growth. After controlling for a series of demographic characteristics, a significant relationship was found for small group instruction on rate of comprehension growth. The association was positive indicating that students who received more frequent small group instruction demonstrated higher rates of reading comprehension growth than students who received less frequent small group instruction. Consistent with this finding, in their meta-analyses, Elbaum et al. (1999) found that elementary students with learning disabilities who received small group instruction demonstrated greater reading growth than their peers who received whole-class instruction, surpassing their performance by approximately 1.5 standard deviations. Inconsistent with this finding and the predictions of this study, the effect of small group instruction on reading fluency growth was non-significant. However, inspection of the pattern of relationships obtained in Elbaum and colleagues' analysis are consistent with those obtained in this study. Findings of the Elbaum analysis revealed a large effect of small group instruction on reading growth when the analysis was collapsed across multiple reading outcomes; however, when the analysis was broken down by reading outcome, differential effects were revealed. In these analyses, small group instruction remained a significant predictor of reading comprehension growth (d = .41) but not of reading fluency growth.

The hypothesized relationship between individual instruction and reading growth was not supported for either outcome. Individual instruction predicted neither growth in reading fluency nor comprehension. These findings differ from existing research, which has consistently found a positive effect of instruction provided individually for both students within the general education (Polloway et al., 1986; Wasik & Slavin, 1993) and special education population (Elbaum et al., 2000; Swanson, 1999). One potential explanation for this unexpected finding may be the age of the sample in the current study. Results from meta-analyses have shown that student age mediates the relationship between individual instruction and reading growth, with larger effect sizes obtained for younger students (Elbaum et al., 2000; Swanson, 1999). Further, from his narrative review of the literature on prevention and remediation of reading deficits, Torgesen (2004) concluded that although struggling readers in the upper elementary grades can demonstrate significant growth if provided with increased instructional intensity,[5] the literature has consistently found that if the decoding deficits of these students are moderate or severe, evidenced-based interventions may be unsuccessful in remediating particular reading skills such as fluency. Torgesen goes on to note that this finding has not been found for younger elementary students and appears to be uniquely problematic for older struggling readers. Thus, it may be that the reading deficits of older struggling readers are less amenable to remediation than those of

[5] Instructional intensity can be increased by the greater individualization of instruction and student engagement that are characteristic of individual and/or small group instruction (Torgesen, 2004).

younger struggling readers and consequently that the inconsistency of the non-significant effect obtained in this study with findings obtained in previous research was influenced by the older sample investigated in this study.

An additional finding from the analyses conducted in this study may provide further insight into interpretation of the mostly non-significant relationships found between individual and small group instruction and reading growth. Controlling for demographic characteristics, a negative relationship was found between initial reading skill and frequency of both individual and small group instruction, that is, students who received frequent instruction in small groups and/or individually had lower initial reading skills than students who received less frequent instruction in small groups and/or individually. Studies have found that those with the lowest initial skills demonstrate the lowest rates of growth (e.g., Al Otaiba & Fuchs, 2006; Torgesen, 2004; Torgesen et al., 1999). Thus, the unexpected non-significant relationship found in this study between instructional grouping practices and reading growth may have been influenced in part by the lower initial skills of students who received more frequent small group and individual instruction.

In addition, the greater effect size of individual instruction as compared to small group instruction on initial reading fluency and comprehension indicates that students who received more frequent individual instruction had more severe initial reading deficits. Therefore, the significant effect of small group instruction on reading comprehension growth and the non-significant effect of individual instruction on both outcomes seem consistent with the notion that the rate of growth demonstrated by students was at least partially a function of their initial skills. However, given that these findings are correlational, further research is needed to assess the accuracy of this potential interpretation.

Limitations

Despite the advantages of studies examining existing large-scale datasets (e.g., the potential to enhance the external validity of the study resulting from large sample sizes), there are several disadvantages of this approach that limit the findings of this study. For one, these studies tend to be correlational and consequently there is a risk that a variable excluded from the study accounts for the correlation between a predictor and the study's outcome. For example, data were not included regarding the type of instruction or instructional materials used within individual and small groups. According to Elbaum and colleagues (1999), these factors likely influence the impact of instruction received in various group formats (e.g., individual, small group) for students with disabilities; achievement gains tend to be largest when instructional materials are individualized to align with each student's needs. Similarly, the SEELS data did not include information related to the specific type of phonics instruction received. Given the wide range of types of phonics instruction (e.g., embedded phonics, synthetic phonics, and analytical phonics), it is possible that effects may have differed across different types of phonics instruction. Further, no data were available on the integrity of implementation of phonics instruction, which may have influenced the estimates obtained.

Another limitation of this study related to the use of large-scale survey data concerns its use of self-reported data. While the outcome data for this study consisted of direct student assessment data, the predictors examined all at least partially relied on self-reported data from teachers. For example, the focus of instruction in this study was determined by teacher ratings of how frequently the child practiced phonics/phonemic skills and how frequently the child had opportunities for silent reading during language arts instruction. As noted by Blanton and colleagues (2006), such self-reports in surveys are often susceptible to bias. However, as noted by Desimone and colleagues (2002), as long as teacher reports of instructional practices are not tied to consequences such as rewards or punitive measures, they are typically similar to those obtained using other methods such as classroom observation (Burstein et al., 1995; Mayer, 1999; Mayer, 1998; Smithson & Porter, 1994). In addition, SEELS data were gathered from teachers between February and May of each year of data collection. Research findings have suggested that teachers are able to accurately recollect their instructional practices if surveyed toward the end of that academic school year (CCSSO, 2000; Gamoran, Porter, Smithson, & White, 1997; Porter, Kirst, Osthoff, Smithson, & Schneider, 1993). Nonetheless, the potential for bias is always present in studies relying on self-reported data.

One strength of this study was that it investigated the reading achievement of older struggling readers across time. However, longitudinal studies are almost always plagued by missing data problems due to attrition (Newman, 2003). Although missing data was addressed in this study using FIML, a method that has been highly recommended for handling missing data in structural equation modeling (Arbuckle, 1999), the potential for bias is always present when large amounts of data are missing for variables of interest. In particular, caution is warranted in interpreting results of this study relating to child-instruction interaction given the possibility that the large portion of data missing for this variable may have influenced results.

Also, there is some uncertainty regarding what slope loadings are most appropriate for modeling students' growth in the SEELS dataset. The SEELS documentation published by SRI in 1999 would seem to suggest that setting the slope loadings to 0, 1, and 3 would be reasonable given that the first wave of direct assessment occurred in 2001; the second wave occurred one year later in 2002; and the wave-3 direct assessment occurred 2 years later in 2004. However, a series of articles conducted by Barnard-Brak and colleagues (i.e., Barnard-Brak &

Lechtenberger, 2009; Barnard-Brak, Sulak, & Fearon, 2010; Barnard-Brak & Thomson, 2009; Barnard et al., 2010) support the slope loadings that were used in this study (0, 2, and 4). They provide the rationale that slope loadings were selected to correspond to the "2-year spacing of the three time points across a data collection period of 4 years" (Barnard-Brak & Thomson, 2009). While it is unlikely that the decision to go with one set of slope loadings over the other would dramatically change the results of this study's analyses, it does raise the question of how one can best model students' academic growth.

This study is also limited by issues concerning measurement. The focus of instruction in this study was determined by teacher ratings of how frequently the child practiced phonics/phonemic skills and how frequently the child had opportunities for silent reading during language arts instruction (i.e., never, rarely, sometimes, or often). Thus, the measures used in this study for the focus of language arts instruction did not provide absolute values such as minutes per week but instead consisted of teacher ratings on a 4-point Likert-type scale. As described in Chapter 3, a 1-point difference on the Likert scale was considered a meaningful difference. However, one frequent criticism of Likert-type scales is that they assume a common distance between responses (e.g., the distance between "never" and "rarely" is the same as the distance between "rarely" and "sometimes"). In future studies, it would be worthwhile to investigate the findings reported here but with more refined measures of instructional practices.

Another limitation of this study that pertains to measurement is its reliance on single-indicator predictor variables. Single-indicator variables are more likely to have lower reliability than multiple-indicator variables. Unreliability of variables, or measurement error, is problematic in that it can bias estimation of regression coefficients. Specifically, measurement error produces inaccurate and smaller regression estimates and decreases the power of the statistical test (i.e., the probability that the null hypothesis wall be rejected when it is false). Although teacher quality was investigated in this study using several variables (teacher experience, education, and professional development), there was no theoretical justification for considering these variables to be components of the same overarching teacher quality construct. Therefore, teacher experience, education, and professional development were each considered to be unique constructs and were each measured with a single indicator. Similarly, there was no theoretical rationale for considering individual and small group instruction to be components of the same instructional grouping practices construct and thus each was considered a unique construct and each was measured with a single-indicator since as was the case for the teacher quality variables, only one item within the SEELS measured each variable. This was also the case for the child-instruction interaction variable; thus, this variable was also measured with only one indicator. Consequently, it is possible that measurement error biased the results of this study and future research is needed to determine the degree to which the findings obtained in this study are replicated when constructs are measured with multiple indicators.

Conclusions

This study investigated hypothesized predictors of reading growth using structural equation modeling, a sophisticated analysis technique that allowed for investigation of the relative impact of hypothesized predictors of achievement. The specific type of structural equation modeling employed was latent growth modeling (LGM), which was used to model change across time using longitudinal data. An advantage of longitudinal research designs is that they allow for investigation of the temporal ordering of a presumed cause and its effect. This is a considerable benefit over cross-sectional designs since one requirement for causal inference is that the cause precedes the effect (Schneider et al., 2007).

Another methodological strength of this study was the large sample size investigated. According to Blanton and colleagues (2006), studies of students in special education that involve large sample sizes are rare. Although students with disabilities are typically included in large-scale, nationally representative studies, special education researchers are not typically able to statistically analyze data for the subsample of students with disabilities because the number of cases is insufficient. Therefore, the large sample investigated in this study contributes to the literature and increases the confidence that can be placed in the findings.

The primary substantive contribution of this study is that it extends results from general education regarding the relationship between child-instruction interaction and reading growth (e.g., Connor et al., 2004; Connor et al., 2009; Hatcher et al., 2004) to upper elementary students in special education. This finding implies that teachers who provide a balance of instructional activities that are targeted to each student's skill level may increase the rate of reading growth achieved. Thus, the balance of instruction that constitutes effective instruction (i.e., the degree to which instruction is word-based or meaning-focused) may vary from one student to the next. This finding is noteworthy because there is little empirical evidence regarding how teachers can most effectively balance instructional activities for students with disabilities (Torgesen et al., 2001).

This study also examined the effect of another hypothesized predictor of reading growth – instructional group size – yet no relationship was found between these variables. However, instructional practices within small groups *that focus on individual students' needs* were not investigated in this study and may partially explain the inconsistency between this finding and those obtained in prior research (e.g., Elbaum et al, 2000). As noted by Otaiba et al. (2009), highly effective teachers tend to provide more frequent small group instruction because it allows for individualization of instruction to student skill level. Previous research has found that reading instruction provided within small groups that is individualized to align with varying student skill levels predicts greater student reading skills (Connor et al., 2008; Connor et al., 2007; Connor et al., 2009; Pressley et al., 2001; Taylor & Pearson, 2004; Wharton-McDonald et al., 1998). As noted by Elbaum et al. (2000), the types of instructional materials used and the degree of differentiation of instruction are important influences on the reading achievement of students with disabilities. Findings from this study supported Elbaum's argument in that students who received instruction more aligned with their skills (i.e., differentiated instruction) demonstrated more reading growth. Therefore, it could be that instructional grouping practices and the degree to which instruction is aligned to student skill levels interact with one another such that an effect of instructional grouping practices would predict student achievement *only* when used in combination with instruction individualized to meet each student's needs. However, this study did not examine this interaction and future research is needed to investigate this possibility.

Similarly, the finding obtained in this study that teacher quality had no effect on student achievement may partially reflect the fact that this study did not look at characteristics of instruction. It may be that teacher quality, instructional practices and student achievement interact in important ways. This is consistent with the theoretical framework proposed by Cohen and colleagues (2003) who argue that research examining the interaction of school resources, instructional practices and student achievement may help educational researchers achieve a more comprehensive and nuanced understanding of the mechanisms underlying student achievement. In fact, child-instruction interaction can be thought of as one example of the kind of variable that Cohen and colleagues are advocating for, as it provides a more nuanced view of the kinds of strategies that effective teachers adopt. However, this study did not investigate the interrelationships among teacher quality, instructional practices, and student achievement; nor did it provide information on other instructional practices (beyond child-instruction interaction) that could predict effective teaching. Thus, future research examining potential interactions among these variables is needed to assess the accuracy of this potential interpretation.

In the current policy context, there is a great need for research on teacher quality to show effects on student achievement; a need that is especially pressing as it pertains to the outcomes of students receiving special education services given the current gap in the literature (Blanton et al., 2006). While the results of this study should be interpreted with caution (pending replication in controlled experimental or quasi-experimental research), they suggest that researchers should look beyond teachers' characteristics (such as their years of experience or educational background) when defining "teacher quality." Instead, student achievement may be best facilitated by determining ways in which classroom teachers can provide instruction individualized to meet each student's needs.

The findings of this study related to child-instruction interaction also have direct implications for the field of school psychology when considered in relation to Response-to-Intervention (RtI) models of service delivery. IDEA (2004) included a provision for school districts to utilize as much as 15% of their special education funding toward Response to Intervention (RtI) services aimed at the prevention of reading problems. Thus, many school districts are moving toward greater provision of services within an RtI framework, which may hold promise for enabling educators to more efficiently and effectively meet the diverse needs of the students they serve. However, there remains uncertainty about the best way to implement RtI in practice, with two alternative approaches having been advanced. The *standard treatment protocol* approach involves providing struggling readers with standardized, evidenced-based interventions (Fuchs, Fuchs, & Compton, 2004; Mathes, Denton, Fletcher, Anthony, Francis, & Schatschneider, 2005; McMaster, Fuchs, Fuchs, & Compton, 2005; Torgesen, Alexander, Wagner, Rashotte, Voeller, Conway, & Rose, 2001). In contrast, the *problem-solving* approach typically involves the development of an individualized intervention by a team of educators that is designed to meet the unique needs of struggling readers (Deno, 2002; Deno et al, 2002; Marston, Muyskens, Lau & Canter, 2003).

As noted by Vaughn et al. (2008), considerable research has supported the effectiveness of interventions that use a standard treatment protocol for struggling readers (e.g., Lovett et al., 1994, 2000; Torgesen et al., 2001; Vellutino et al., 1996; Wise, Ring & Olson, 1999). And, although problem-solving models have been implemented in practice (e.g., Ikeda, Tilly, Stumme, Volmer, & Allison, 1996; Marston, Muyskens, Lau, & Canter, 2003), no experimental or quasi-experimental research has been conducted evaluating the effectiveness of the individualized interventions developed within a problem-solving approach to RtI (Fuchs et al., 2003). Although the findings from this study pertaining to the effect of child-instruction interaction on student reading growth were correlational, they do provide evidence supporting conditions under which individualized interventions may be effective. Individualized instruction may be particularly important for older struggling readers since the reading difficulties experienced by these students tends to vary more greatly than those of younger struggling readers; further, this populations is also likely to have received standardized interventions that were unsuccessful (Vaughn et al., 2008).

One potential implication of the effect found for child-instruction interaction on reading growth is that teachers may be able to enhance reading achievement by frequently monitoring student progress and using assessment results to guide instructional planning. The feasibility of providing individualized instruction within a large, general education class may appear questionable to many teachers, especially given the fact that despite smaller class sizes, many special educators may be unable to provide intensive, individualized instruction. According to Vaughn et al. (2008), one reason for this is that special educators are often burdened by heavy caseloads given that many students without disabilities are placed in special education. However, findings from recent research investigating strategies teachers may use to increase their ability to provide individualized instruction are encouraging. For example, researchers have found that reading instruction that is provided daily for between 45 and 120 minutes, with the majority of instruction delivered within small-groups, leads to greater student achievement (Connor, Morrison, Fishman, & Schatschneider, 2008; Connor, Morrison, Fishman, Schatschneider, & Underwood, 2007; Connor et al., 2009; Pressley et al., 2001; Taylor & Pearson, 2004; Wharton-McDonald, Pressley, & Hampston, 1998). Further, research suggests that technology may be one promising strategy for teachers to use to enhance their ability to provide differentiated instruction.[6]

Despite the potential promise of the current study's findings, it should be noted that child-instruction interaction was explored in isolation in this study and not within a multi-tiered RtI service delivery system. Thus, caution is warranted in the interpretation of these findings as they pertain to existing RtI research. Overall, however, the results suggest that teachers of older students who struggle with reading could potentially individualize interventions by aligning instructional approaches with student needs.

---

[6] Assessment to Instruction (A2i), a recently developed software program uses student assessment data to provide recommendation for the amount of time per day instruction should focus on a particular activity in order for the student to reach the proficiency required by the end of the academic school year (Connor et al., 2007; http://isi.fcrr.org).

APPENDICES

Table 1

Approximate Dates of Data Collection

Instrument	**Wave 1**	**Wave 2**	**Wave 3**
Parent interview	3/00-6/00	3/02-6/02	3/04-6/04
Teacher survey	2/01-5/01	2/02-5/02	2/04-5/04
Direct assessment	2/01-5/01	2/02-5/02	2/04-5/04

Table 2

Hypothesized Predictors of Reading Growth

Predictors	**Description**
Professional development[a]	Min. of 8 hrs of professional development over past 3 yrs
Education[b]	Highest level of education completed by the teacher
Experience[c]	Number of yrs respondent has taught
Small group instruction[d]	Frequency during language arts instruction
Individual instruction[d]	Frequency during language arts instruction
Child-instruction interaction[e]	Degree to which instruction aligned with student skill level

a=(0=no; 1=yes); b=(range=1-7; 1=high school diploma, 7=doctoral degree); c=(range=0-47 years); d=(range=1-4; 1= never, 4=often); e=(range=1-3; 1=low, 3=high)

Table 3

Coding of Child-Instruction Interaction Variable

Child-Instruction Interaction		**Phonics**	**Silent Reading**
High	Low reading accuracy	Often	Sometimes
		Often	Rarely
		Often	Never
		Sometimes	Rarely
		Sometimes	Never
		Rarely	Never
High	High reading accuracy	Sometimes	Often
		Rarely	Often
		Never	Often
		Rarely	Sometimes
		Never	Sometimes
		Never	Rarely
Medium	Low reading accuracy	Often	Often
		Sometimes	Sometimes
		Rarely	Rarely
		Never	Never
Medium	High reading accuracy	Often	Often
		Sometimes	Sometimes
		Rarely	Rarely
		Never	Never
Low	Low reading accuracy	Sometimes	Often
		Rarely	Often
		Never	Often
		Rarely	Sometimes
		Never	Sometimes
		Never	Rarely
Low	High reading accuracy	Often	Sometimes
		Often	Rarely
		Often	Never
		Sometimes	Rarely
		Sometimes	Never
		Rarely	Never

Table 4

Correlation Matrix of Predictor Variables

	1	2	3	4	5	6	7	8	9	10
1										
2	-.133									
3	.271	-.178								
4	.053	.089	-.023							
5	-.034	.027	.034	.027						
6	.070	-.052	.044	.039	.367					
7	-.114	.070	-.110	.040	.021	.034				
8	-.160	.069	.014	-.145	-.033	.017	.055			
9	-.003	.070	-.040	.003	.011	.025	.000	.023		
10	-.051	-.013	-.112	.102	.046	.000	.060	-.101	-.031	
11	-.113	.000	-.088	.067	.044	.018	.068	-.023	-.041	.456

Note. 1=Small group instruction; 2=whole-class instruction; 3=individual instruction; 4=teacher professional development; 5=teacher experience; 6=teacher education; 7=child-instruction interaction; 8=age; 9=gender; 10=maternal education; 11=income

Table 5

Missing Data for Hypothesized Predictors

Predictors	**Missing rate (%)**
Teacher Quality	
Professional development	2%
Education	1%
Experience	2%
Child-instruction interaction	50%
Instructional Grouping	
Small group instruction	2%
Individual instruction	2%

Table 6

Missing Data Rates (%) for Reading Achievement

Reading Outcome	**Wave 1**	**Wave 2**	**Wave 3**
Fluency	33%	18%	20%
Comprehension	28%	14%	18%

Table 7

Demographic Characteristics of Weighted Sample without Missing Data Estimated

Variable	**N**	**%**
Ethnicity	2298	100
Caucasian	1663	72
African American	379	17
Hispanic	197	9
Asian/Pacific Islander	33	1
American Indian/Alaska Native	17	1
Multiple/other	9	<1
Household Income	2919	100
Less than $25,000	999	34
$25,000-$50,000	881	30
More than $50,000	1039	36
Maternal Education	2877	100
Less than high school	395	14
High school/GED	1007	35
Some college	836	29
BA/BS or higher	639	22
Gender	2296	100
Male	1512	66
Female	784	34
Disability Status	2299	100
Learning Disability	287	13
Spch./Lang. Impairment	243	11
Mental Retardation	229	10
Emotional Disturbance	200	9
Hearing Impairment	197	9
Vision Impairment	152	7
Orthopedic Impairment	243	11
Other Health Impairment	299	13
Autism Spectrum Disorder	249	11
Traumatic Brain Injury	78	3
Multiple Disabilities	120	5
Deaf/Blindness	2	<1

Table 8

Reading Achievement Across Disability Status

	Reading Fluency Mean (SD)						Reading Comprehension Mean (SD)					
Disability	**Time 1**		**Time 2**		**Time 3**		**Time 1**		**Time 2**		**Time 3**	
LD	75.68	(44.49)	90.92	(43.17)	114.02	(45.87)	484.25	(20.56)	489.99	(20.54)	497.03	(15.33)
SI	94.96	(45.34)	114.01	(44.79)	138.45	(41.62)	487.98	(18.48)	494.16	(17.86)	501.79	(15.22)
MR	48.93	(41.27)	61.60	(46.70)	76.17	(51.21)	459.80	(28.56)	467.16	(25.79)	474.85	(23.81)
ED	97.37	(53.53)	115.69	(50.79)	129.44	(53.33)	488.41	(19.00)	493.68	(19.85)	500.22	(15.98)
HI	97.85	(45.63)	112.01	(44.38)	133.30	(47.00)	483.55	(21.77)	495.59	(17.49)	495.29	(19.23)
VI	81.12	(45.23)	98.95	(49.72)	117.74	(52.91)	486.81	(22.60)	497.57	(19.66)	501.09	(20.78)
OI	80.64	(49.96)	97.63	(52.87)	114.04	(54.07)	483.97	(23.80)	489.53	(24.01)	496.69	(21.98)
OHI	91.16	(51.58)	104.09	(49.30)	124.28	(48.69)	487.29	(24.01)	492.45	(20.10)	499.45	(16.97)
ASD	84.22	(56.05)	98.42	(50.64)	115.00	(48.69)	473.63	(26.59)	479.15	(25.75)	487.15	(22.18)
TBI	70.46	(47.69)	87.46	(55.85)	109.87	(54.12)	479.16	(25.96)	487.22	(22.63)	489.18	(21.91)
Mult.	45.05	(41.33)	53.99	(46.40)	62.79	(49.24)	454.87	(29.22)	462.57	(27.15)	471.17	(26.44)
Df/blnd	84.41	(47.43)	99.79	(48.39)	121.10	(49.34)	484.31	(21.50)	490.11	(20.19)	496.29	(18.65)
All	79.44	(50.61)	94.26	(51.57)	113.20	(53.58)	483.04	(25.68)	485.98	(24.70)	493.25	(22.09)

Note. LD=learning disability; SI=speech/language impairment; MR=mental retardation; ED=emotional disturbance; HI=hearing impairment; VI=vision impairment; OI=orthopedic impairment; OHI=other health impairment; ASD=autism spectrum disorder; TBI=traumatic brain injury; Mult.=multiple disabilities; Df/blnd=deafness or blindness; All=all disabilities

Table 9

Impact of Child-Instruction Interaction on Reading Fluency

	Unconditional Model Estimate (SE)	Child-Instruction Interaction Estimate (SE)	Control Variables Estimate (SE)
Random Variance			
Intercept	***2360.04 (108.59)	***2099.66 (87.67)	***1725.65 (80.52)
Linear Slope	***37.24 (9.09)	4.43 (5.04)	6.60 (4.06)
Fixed Effects			
Intercept	***79.44 (1.98)	***78.70 (1.95)	***78.71 (10.77)
Linear Slope	***9.35 (0.28)	***9.36 (0.90)	***9.32 (1.97)
CI x Slope		**0.99 (0.36)	**0.89 (0.32)
Age			***7.24 (0.86)
Age x Slope			***-1.13 (0.14)
Gender			***12.71 (3.44)
Gender x Slope			-0.15 (0.54)
Mat Ed			***8.99 (1.54)
Mat Ed x Slope			0.21 (0.30)
Incme			***11.93 (2.00)
Incme x Slope			0.09 (0.33)
Goodness of Fit			
$\chi 2$ (df)	**9.91 (1)	***39.39 (4)	***63.09 (8)
RMSEA	0.05	0.05	0.05

Note. SE=standard error; *p<.05; ** p<.01; ***p<.001

Table 10

Impact of Child-Instruction Interaction on Reading Comprehension

	Unconditional Model Estimate (SE)	Child-Instruction Interaction Estimate (SE)	Control Variables Estimate (SE)
Random Variance			
Intercept	***433.05 (31.55)	***301.67 (18.91)	***248.94 (18.08)
Linear Slope	***10.70 (2.43)	***5.05 (1.37)	**3.39 (1.25)
Fixed Effects			
Intercept	***483.04 (0.80)	***482.94 (0.80)	***482.96 (5.16)
Linear Slope	***3.32 (0.16)	***3.33 (0.49)	***3.31 (1.22)
CI x Slope		**0.59 (0.21)	*0.53 (0.22)
Age			***3.22 (0.33)
Age x Slope			***-0.60 (0.09)
Gender			1.82 (1.19)
Gender x Slope			-0.29 (0.31)
Mat Ed			***3.22 (0.78)
Mat Ed x Slope			0.06 (0.17)
Incme			***5.86 (0.91)
Incme x Slope			*-0.50 (0.22)
Goodness of Fit			
$\chi 2$ (df)	0.38 (1)	***29.62 (4)	***28.98 (8)
RMSEA	0.00	0.00	0.03

Note. SE=standard error; *p<.05; ** p<.01; ***p<.001

Table 11

Impact of Child-Instruction Interaction on Reading Fluency: Effect Size Estimates

	Initial Status	**Growth**
	Stnd Est	**Stnd Est**
CI		**0.2
Age	***0.29	***-0.62
Gender	***0.13	-0.02
Mat Ed	***0.19	0.06
Incme	***0.21	0.02

Note. *p<.05; ** p<.01; ***p<.001

Table 12

Impact of Child-Instruction Interaction on Reading Comprehension: Effect Size Estimates

	Initial Status **Stnd Est**	**Growth** **Stnd Est**
CI		*0.4
Age	***0.33	***-1.13
Gender	0.05	-0.14
Mat Ed	***0.17	0.06
Incme	***0.27	*-0.41

Note. *p<.05; ** p<.01; ***p<.001

Table 13

Impact of Teacher Quality on Reading Fluency

	Unconditional Model	Prof. Developmt	Experience	Education	Control Variables
	Estimate (SE)	**Estimate (SE)**	**Estimate (SE)**	**Estimate (SE)**	**Estimate (SE)**
Random Variance					
Intercept	***2360.04 (108.59)	***2103.44 (84.43)	***2098.87 (84.34)	***2098.55 (85.00)	***1721.19 (80.09)
Linear Slp	***37.24 (9.09)	6.59 (5.22)	5.90 (5.10)	5.59 (5.09)	7.84 (4.09)
Fixed Effects					
Intercept	***79.44 (1.98)	***71.17 (2.74)	***69.51 (3.97)	***72.40 (7.54)	***78.86 (12.50)
Linear Slp	***9.35 (0.28)	***9.32 (0.56)	***8.53 (0.66)	***9.60 (1.24)	***9.30 (1.86)
Prof dev		**9.99 (3.37)	**9.94 (3.40)	**9.99 (3.38)	***9.93 (2.84)
Prof dev x Slp		0.05 (.59)	-0.01 (0.57)	0.02 (0.57)	-0.47 (0.56)
Experience			0.13 (0.21)	0.15 (0.21)	0.22 (0.20)
Experience x Slp			*0.06 (0.03)	*0.07 (0.03)	0.05 (0.03)
Education				-0.77 (1.68)	-2.26 (1.55)
Education x Slp				-0.29 (0.27)	-0.12 (0.25)
Age					***7.52 (0.84)
Age x Slp					***-1.11 (0.14)
Gender					***12.28 (3.40)
Gender x Slp					-0.13 (0.52)
Mat educ					***9.00 (1.54)
Mat educ x Slp					9.00 (0.31)

Table 13 (cont'd)

	Unconditional Model	Prof. Developmt	Experience	Education	Control Variables
	Estimate (SE)	**Estimate (SE)**	**Estimate (SE)**	**Estimate (SE)**	**Estimate (SE)**
Incme					***11.77 (2.04)
Incme x Slp					0.13 (0.34)
Goodness of Fit					
$\chi 2$ (df)	**9.91 (1)	**23.72 (3)	***27.95 (4)	***32.84 (5)	***43.08 (9)
RMSEA	0.05	0.05	0.04	0.04	0.04

Note. SE=standard error; *p<.05; ** p<.01; ***p<.001

Table 14

Impact of Teacher Quality on Reading Comprehension

	Unconditional Model	Prof. Developmt	Experience	Education	Control Variables
	Estimate (SE)	**Estimate (SE)**	**Estimate (SE)**	**Estimate (SE)**	**Estimate (SE)**
Random Variance					
Intercept	***433.05 (31.55)	***304.38 (18.55)	***303.28 (18.38)	***303.36 (18.31)	***249.27 (17.38)
Slp	***10.70 (2.43)	**4.37 (1.45)	**4.49 (1.47)	**4.50 (1.46)	*2.89 (1.31)
Fixed Effects					
Intercept	***483.04 (0.80)	***480.26 (1.41)	***479.44 (1.99)	*** 477.60 (3.44)	***482.97 (5.19)
Slp	***3.32 (0.16)	***3.62 (0.32)	***3.38 (0.42)	***4.15 (0.77)	***3.30 (1.13)
Prof dev		*3.55 (1.59)	*3.51 (1.59)	*3.47 (1.57)	*3.85 (1.53)
Prof dev x Slp		-0.40 (0.33)	0.06 (0.10)	-0.40 (0.33)	-0.63 (0.33)
Experience			0.12 (0.02)	0.05 (0.10)	0.08 (0.10)
Experience x Slp			0.02 (0.02)	0.03 (0.02)	0.02 (0.02)
Education				0.49 (0.71)	-0.22 (0.65)
Education x Slp				-0.20 (0.15)	-0.10 (0.15)
Age					***3.34 (0.33)
Age x Slp					***-0.60 (0.08)
Gender					1.66 (1.19)
Gender x Slp					-0.26 (0.29)
Mat educ					***3.20 (0.79)
Mat educ x Slp					0.09 (0.17)

Table 14 (cont'd)

	Unconditional Model	Prof. Developmt	Experience	Education	Control Variables
	Estimate (SE)	**Estimate (SE)**	**Estimate (SE)**	**Estimate (SE)**	**Estimate (SE)**
Incme					***5.90 (0.92)
Incme x Slp					*-0.46 (0.21)
Goodness of Fit					
$\chi 2$ (df)	0.14 (1)	***23.22 (3)	***26.39 (4)	***27.92 (5)	*25.16 (9)
RMSEA	0.00	0.05	0.04	0.04	0.02

Note. SE=standard error; *p<.05; ** p<.01; ***p<.001

Table 15

Impact of Teacher Quality on Reading Fluency: Effect Size Estimates

	Initial Status Stnd Est	Growth Stnd Est
Prof dev	***0.09	-0.06
Experience	0.04	0.13
Education	-0.05	-0.03
Age	***0.30	***-0.58
Gender	***0.12	-0.02
Mat educ	***0.19	0.07
Incme	***0.21	0.03

Note. *p<.05; ** p<.01; ***p<.001

Table 16

Impact of Teacher Quality on Reading Comprehension: Effect Size Estimates

	Initial Status	**Growth**
	Stnd Est	**Stnd Est**
Prof dev	*0.09	-0.27
Experience	0.04	0.16
Education	-0.01	-0.11
Age	***0.34	***-1.13
Gender	0.04	-0.12
Mat educ	***0.17	0.09
Incme	***0.27	*-0.38

Note. *p<.05; ** p<.01; ***p<.001

Table 17

Impact of Instructional Group on Reading Fluency

	Unconditional Model	Small Grp Instruction	Individual Instruction	Control Variables
	Estimate (SE)	Estimate (SE)	Estimate (SE)	Estimate (SE)
Random Variance				
Intercept	***2360.04 (108.59)	***1883.92 (83.60)	***1757.06 (77.25)	***1517.09 (74.10)
Linear Slp	***37.24 (9.09)	8.29 (4.45)	6.39 (4.21)	*8.17 (3.53)
Fixed Effects				
Intercept	***79.44 (1.98)	***78.79 (7.62)	***78.75 (8.76)	***78.86 (14.26)
Linear Slp	***9.35 (0.28)	***9.35 (1.37)	***9.35 (1.53)	***9.31 (2.11)
Small grp		***-23.82 (2.15)	***-18.08 (2.07)	***-12.71 (2.06)
Small grp x Slp		0.66 (0.40)	0.81 (0.40)	0.30 (0.36)
Individual			***-15.99 (2.25)	***-14.70 (1.95)
Individual x Slp			-0.45 (0.30)	-0.06 (0.28)
Age				***6.71 (0.80)
Age x Slp				***-1.11 (0.14)
Gender				***9.89 (2.91)
Gender x Slp				-0.08 (0.52)
Mat educ				***7.65 (1.44)
Mat educ x Slp				0.22 (0.31)
Incme				***8.91 (1.91)
Incme x Slp				0.20 (0.31)

Table 17 (cont'd)

	Unconditional Model Estimate (SE)	Small Grp Instruction Estimate (SE)	Individual Instruction Estimate (SE)	Control Variables Estimate (SE)
Goodness of Fit				
$\chi2$ (df)	**9.91 (1)	***22.49 (3)	***31.05 (4)	***45.80 (8)
RMSEA	0.05	0.05	0.05	0.04

Note. SE=standard error; *p<.05; ** p<.01; ***p<.001

Table 18

Impact of Instructional Group on Reading Comprehension

	Unconditional Model Estimate (SE)	**Small Grp Instruction Estimate (SE)**	**Individual Instruction Estimate (SE)**	**Control Variables Estimate (SE)**
Random Variance				
Intercept	***433.05 (31.55)	***283.46 (18.55)	***264.36 (17.56)	***226.18 (16.91)
Linear Slp	***10.70 (2.43)	**3.72 (1.38)	**3.70 (1.37)	2.42 (1.27)
Fixed Effects				
Intercept	***483.04 (0.80)	***482.95 (3.02)	***482.95 (3.13)	***482.97 (6.55)
Linear Slp	***3.32 (0.16)	3.32 (0.78)	3.32 (0.86)	***3.30 (1.73)
Small grp		***-8.46 (0.89)	***-6.16(0.93)	***-3.74 (0.89)
Small grp x Slp		***0.73 (0.21)	**0.72 (0.24)	0.37 (0.23)
Individual			***-6.34 (0.90)	***-5.91 (0.85)
Individual x Slp			-0.01 (0.24)	0.13 (0.25)
Age				***3.07 (0.33)
Age x Slp				***-0.58 (0.09)
Gender				0.84 (1.12)
Gender x Slp				-0.23 (0.30)
Mat educ				***2.69 (0.77)
Mat educ x Slp				0.09 (0.17)
Incme				***4.93 (0.88)
Incme x Slp				-0.40 (0.22)

Table 18 (cont'd)

	Unconditional Model Estimate (SE)	Small Grp Instruction Estimate (SE)	Individual Instruction Estimate (SE)	Control Variables Estimate (SE)
Goodness of Fit				
$\chi 2$ (df)	0.38 (1)	***19.90 (3)	***22.92 (4)	**23.04 (8)
RMSEA	0.00	0.04	0.04	0.02

Note. SE=standard error; *p<.05; ** p<.01; ***p<.001

Table 19

Impact of Instructional Group on Reading Fluency: Effect Size Estimates

	Initial Status	**Growth**
	Stnd Est	**Stnd Est**
Small grp	***-0.18	0.06
Individual	***-0.23	-0.01
Age	***0.27	***-0.58
Gender	***0.1	-0.01
Mat educ	***0.16	0.06
Incme	***0.16	0.05

Note. *p<.05; ** p<.01; ***p<.001

Table 20

Impact of Instructional Group on Reading Comprehension: Effect Size Estimates

	Initial Status	**Growth**
	Stnd Est	**Stnd Est**
Small grp	***-0.14	0.25
Individual	***-0.23	0.09
Age	***0.31	***-1.08
Gender	0.02	-0.11
Mat educ	***0.14	0.09
Incme	***0.22	-0.33

Note. *p<.05; ** p<.01; ***p<.001

Table 21

Impact of each type of Predictor on Reading Fluency

	Unconditional Model Estimate (SE)	Child-Instruction Interaction Estimate (SE)	Small Grp Instruction Estimate (SE)	Prof Developmt Estimate (SE)	Controls Estimate (SE)
Random Variance					
Intercept	***2360.04 (108.59)	***2099.66 (87.67)	***1866.39 (83.16)	***1847.51 (80.47)	***1585.70 (74.75)
Linear Slp	***37.24 (9.09)	4.43 (5.04)	6.42 (4.31)	6.49 (4.35)	*7.51 (3.62)
Fixed Effects					
Intercept	***79.44 (1.98)	***78.70 (1.95)	***78.74 (7.57)	***78.73 (7.51)	***78.83 (14.78)
Linear Slp	***9.35 (0.28)	***9.36 (0.90)	*9.36 (1.81)	*9.36 (1.74)	***9.32 (2.13)
CI x Slp		**0.99 (0.36)	**1.02 (0.36)	**1.01 (0.37)	**0.87 (0.33)
Small			***-23.68 (2.14)	***-23.71 (2.14)	***-17.79 (2.27)
Small x Slp			*0.86 (0.41)	*0.86 (0.41)	0.45 (0.35)
Prof dev				***10.18 (3.02)	***9.77 (2.71)
Prof dev x Slp				-0.03 (0.59)	-0.51 (0.56)
Age					***6.37 (0.80)
Age x Slp					***-1.12 (0.14)
Gender					***10.77 (3.08)
Gender x Slp					-0.08 (0.52)
Mat educ					***8.37 (1.46)
Mat educ x Slp					0.21 (0.31)
Incme					***9.59 (1.91)
Incme x Slp					0.16 (0.31)

Table 21 (cont'd)

	Unconditional Model Estimate (SE)	Child-Instruction Interaction Estimate (SE)	Small Grp Instruction Estimate (SE)	Prof Developmt Estimate (SE)	Controls Estimate (SE)
Goodness of Fit					
$\chi 2$ (df)	**9.91 (1)	***39.39 (4)	***43.94 (5)	***56.09 (6)	***73.06 (10)
RMSEA	0.05	0.05	0.05	0.05	0.05

Note. SE=standard error; *p<.05; ** p<.01; ***p<.001

Table 22

Impact of each type of Predictor on Reading Comprehension

	Unconditional Model Estimate (SE)	Child-Instruction Interaction Estimate (SE)	Small Grp Instruction Estimate (SE)	Prof Developmt Estimate (SE)	Controls Estimate (SE)
Random Variance					
Intercept	***433.05 (31.55)	***301.67 (18.91)	***280.16 (18.56)	***278.26 (18.21)	***237.40 (17.54)
Linear Slp	***10.70 (2.43)	***5.05 (1.37)	**4.23 (1.31)	**4.12 (1.32)	*2.91 (1.22)
Fixed Effects					
Intercept	***483.04 (0.80)	***482.94 (0.80)	***482.94 (2.99)	***482.92 (3.27)	***482.95 (6.24)
Linear Slp	***3.32 (0.16)	***3.33 (0.49)	3.33 (1.00)	3.34 (1.05)	***3.31 (1.51)
CI x Slp		**0.59 (0.21)	**0.56 (0.21)	**0.56 (0.21)	*0.49 (0.22)
Small			***-8.30 (0.88)	***-8.31 (0.88)	***-5.68 (0.92)
Small x Slp			***0.84 (0.22)	***0.84 (0.22)	**0.51 (0.22)
Prof dev				*3.61 (1.52)	*3.82 (1.54)
Prof dev x Slp				-0.44 (0.34)	-0.65 (0.34)
Age					***2.98 (0.32)
Age x Slp					***-0.59 (0.80)
Gender					1.15 (1.16)
Gender x Slp					-0.22 (0.30)
Mat educ					***2.99 (0.78)
Mat educ x Slp					0.08 (0.18)
Incme					***5.12 (0.89)
Incme x Slp					*-0.42 (0.21)

Table 22 (cont'd)

	Unconditional Model Estimate (SE)	Child-Instruction Interaction Estimate (SE)	Small Grp Instruction Estimate (SE)	Prof Developmt Estimate (SE)	Controls Estimate (SE)
Goodness of Fit					
χ2 (df)	0.14 (1)	***29.62 (4)	***28.49 (5)	***32.47 (6)	**28.46 (10)
RMSEA	0.00	0.00	0.04	0.04	0.02

Note. SE=standard error; *p<.05; ** p<.01; ***p<.001

Table 23

Impact of each type of Predictor on Reading Fluency: Effect Size Estimates

	Initial Status	**Growth**
	Stnd Est	**Stnd Est**
CI		**0.07
Small	***-0.15	0.03
Prof dev	***0.04	-0.02
Age	***0.43	***-1.07
Gender	***0.09	-0.02
Mat educ	***0.17	0.07
Incme	***0.16	0.05

Note. *p<.05; ** p<.01; ***p<.001

Table 24

Impact of each type of Predictor on Reading Comprehension: Effect Size Estimates

	Initial Status	**Growth**
	Stnd Est	**Stnd Est**
CI		*0.07
Small	***-0.12	**0.07
Prof dev	*0.04	-0.05
Age	***0.50	***-0.94
Gender	-0.04	-0.03
Mat educ	***0.16	0.05
Incme	***0.23	*-0.12

Note. *p<.05; ** p<.01; ***p<.001

BIBLIOGRAPHY

BIBLIOGRAPHY

Adams, M. J. (1994). *Beginning to read.* Cambridge, MA: MIT Press.

Alley, G. A., Deshler, D. D., Clark, F., Schumaker, J. B., & Warner, M. M. (1983). Learning disabilities in adolescent and adult populations: Research implications (Part II). *Focus on Exceptional Children, 15,* 1-14.

Al Otaiba, S., & Fuchs, D. (2006). Who are the young children for whom best practices in reading are ineffective? An experimental and longitudinal study. Journal of Learning Disabilities, 39(5), 414-431.

Anderson, E. S., & Keith, T. Z. (1997). A longitudinal test of a model of academic success for at-risk high school students. *The Journal of Educational Research, 90,* 259-268.

Archer, A. L., Gleason, M. M., & Vachon, V. L. (2003). Decoding and fluency: Foundation skills for struggling older readers. *Learning Disability Quarterly, 26,* 89-101.

Ardoin, S. P., & Christ, T. J. (2009). Curriculum-based measurement of oral reading: Standard errors associated with progress monitoring outcomes from DIBELS, AIMSweb, and an experimental passage set. *School Psychology Review, 28*(2), 266-283.

Aunola, K., Leskinen, E., Onatsu-Arvilommi, T., & Nurmi, J. E. (2002). Three methods of studying developmental change: A case of reading skills and self-concept. *British Journal of Educational Psychology, 72*, 343-360.

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

Barnard-Brak, L., & Lechtenberger, D. (2009). Student IEP participation and academic achievement across time. *Remedial and Special Education, 31*(5), 343-349.

Barnard-Brak, L., Stevens, T., To, Y. M., Lan, W. Y., & Mulsow, M. (2010) The importance of ADHD subtype classification for educational applications of DSM-V. *Journal of Attention Disorders, 13*, 573-583.

Barnard-Brak, L., Sulak, T. N., & Fearon, D. D. (2010). Coexisting disorders and academic achievement among children with ADHD. *Journal of Attention Disorders, 13,* 1-10.

Barnard-Brak, L., & Thomson, D. (2009). How is taking care of caregivers of children with disabilities related to academic achievement? *Child and Youth Care Forum*, *38*(2), 91-102.

Bast, J., & Reitsma, P. (1997). Matthew effects in reading: A comparison of latent growth curve models and simplex models with structured means. *Multivariate Behavioral Research, 32,* 135-167.

Berliner, D. C. (1984). The half-full glass: A review of research on teaching. In P. L. Hasford (Ed.), *Using what we know about teaching* (pp. 51-77). Alexandria, VA: Association for Supervision and Curriculum Development.

Bhat, P., Griffin, C. C., & Sindelar, P. T. (2003). Phonological awareness instruction for middle school students with learning disabilities. *Learning Disability Quarterly, 26,* 73-87.

Bhattacharya, A., & Ehri, L. C. (2004). Graphosyllabic analysis helps adolescent struggling readers read and spell words. *Journal of Learning Disabilities, 37*, 331-348.

Bollen, K. A. (1989). Structural equations with latent variables. New York: Wiley.

Borland, M. V., & Howsen, R. M. (1992). Student academic achievement and the degree of market concentration in education. *Economics of Education Review, 11,* 31-39.

Bradley, L., & Bryant, P. (1983). Categorizing sounds and learning to read: A causal connection. *Nature*, *30,* 419-421.

Brady, S., Fowler, A., Stone, B., & Winbury, N. (1994). Training in phonological awareness. A study with inner-city kindergarten children. *Annals of Dyslexia, 44*, 26-58.

Brantlinger, E. (1996). Influence of preservice teachers' beliefs about pupil achievement on attitudes toward inclusion. *Teacher Education and Special Education, 19,* 17-33.

Brown, A. L, & Campione, J. C. (1986). Psychological theory and the study of learning disabilities. *American Psychologist, 41,* 1059-1068.

Carroll, J. B. (1963). A model for school learning. *Teachers College Record, 64*, 723-733.

Carroll, J. B. (1989). The Carroll Model: A 25-year retrospective and prospective view. *Educational Researcher, 18*(1), 26-31.

Christ, T. J., & Ardoin, S. P. (2009). Curriculum-based measurement of oral reading: Passage equivalence and probe-set development. *Journal of School Psychology, 47,* 55-75.

Cizek, G. C. (2001). Test review of the *Woodcok-Johnson III.* From B. S. Plake, J. C. Impara, & R. A. Spies (Eds.), *The fifteenth mental measurements yearbook* [Electronic version]. Retrieved June 20, 2009, from the Buros Center for Testing Web site: http://www.unl.edu/buros

Cochran-Smith, M., & Fries, K. (2005). The AERA panel on research and teacher education: Context and goals. In *Studying Teacher Education* (Eds. M. Cochran-Smith & K. M. Zeichner).

Cohen, D., Raudebush, S. W., & Lowenberg Ball, D. (2003). Resources, instruction, and research. *Educational Evaluation and Policy Analysis, 25,* 119-142.

Coleman, J. S., Campbell, E. Q., Hobson, C. J., McPartland, J., Mood, A. M., Weinfeld, F. D., & York, R. L. (1966). *Equality of educational opportunity.* Washington, DC: Government Printing Office.

Connor, C. M., Jakobsons, L. J., Crowe, E., & Meadows, J. (2009). Instruction, differentiation, and student engagement in Reading First classrooms. *Elementary School Journal, 109,* 221-250.

Connor, C. M., Morrison, F. J., Fishman, B. J., Schatschneider, C., & Underwood, P. (2007, January 26). Algorithm-guided individualized reading instruction. *Science*, *315*, 464-465.

Connor, C. M., Morrison, F. J., & Katch, E. L. (2004). Beyond the Reading Wars: the effect of classroom instruction by child interactions on early reading. *Scientific Studies of Reading, 8,* 305-336.

Connor, C. M., Morrison, F. J., & Petrella, J. N. (2004). Effective reading comprehension instruction: Examining child by instruction interactions. *Journal of Educational Psychology, 96*(4), 682-698.

Connor, C. M., Piasta, S. B., Fishman, B., Glasney, S., Schatschneider, C., Crowe, E., Underwood, P., & Morrison, F. J. (2009). Individualizing student instruction precisely: Effects of child by instruction interactions on first graders' literacy development. *Child Development*, *80,* 77–100.

Connor, C. M., Son, S. H., Hindman, A., & Morrison, F. J. (2005). Teacher qualifications, classroom practices, and family characteristics: Complex effects on first graders' language and early reading. *Journal of School Psychology, 43,* 343-375.

Cool, V. A. & Keith, T. Z. (1991). Testing a model of school learning: Direct and indirect effects on academic achievement. *Contemporary Educational Psychology, 16,* 28-44.

Cunningham, A. E. (1990). Explicit v. implicit instruction in phonemic awareness. *Journal of Experimental Child Psychology, 50,* 429-444.

Deno, S. L. (1985). Curriculum-based measurement: The emerging alternative. *Exceptional Children, 52,* 219-232.

Deno, S. L. (2001). Developments in curriculum-based measurement. *The Journal of Special Education, 37*, 184-192.

Deno, S., Fuchs, L., Marston, D., & Shin, J. (2001). Using curriculum-based measurement to establish growth patterns for students with learning disabilities. *School Psychology Review, 30,* 507-524.

Deno, S., & Marston, D. (1986). *Standard Reading Passages.* Minneapolis, MN: Educational Services Publications.

Deno, S. L., Mirkin, P. K., & Chiang, B. (1982). Identifying valid measures of reading. *Exceptional Children, 49,* 36-45.

Deno, S. L., Marston, D., Mirkin, P., Lowry, L., Sindelar, P., & Jenkins, J. (1982). The use of standard tasks to measure achievement in reading, spelling, and written expression: A normative and developmental study (Research Report No. 87). Minneapolis, MN: Institute for Research on Learning Disabilities, University of Minnesota.

Desimone, L. M., Porter, A. C., Garet, M. S., Suk Yoon, K., & Birman, B. F. (2002). Effects of professional development on teachers' instruction: Results from a three-year longitudinal study. *Educational Evaluation and Policy Analysis, 24,* 81-112.

DiPerna, J. C. & Elliott, S. N. (1999). Development and validation of the academic competence evaluation scales. *Journal of Psychoeducational Assessment, 17,* 207-225.

DiPerna, J. C. & Elliott, S. N. (2000). *Academic competence evaluation scales*. San Antonio, TX: The Psychological Corporation.

DiPerna, J. C., Elliott, S. N., & Volpe, R. J. (2002). A model of academic enablers and elementary reading/language arts achievement. *School Psychology Review, 31,* 298-312.

DOE. (2004a). *Meeting the highly qualified teachers challenge: The secretary's third annual report on teacher quality*. Washington, DC: U.S. Department of Education, Office of Postsecondary Education.

DOE. (2004b). *No child left behind: A toolkit for teachers.* Washington, DC: U.S. Department of Education, Office of the Deputy Secretary.

Duncan, T. E., & Duncan, S. C. (1995). Modeling the processes of development via latent variable growth curve methodology. *Structural Equation Modeling, 2,* 178-213.

Duncan, T. E., Duncan, S. C., & Li, F. (1998). A comparison of model- and multiple imputation-based approaches to longitudinal analysis with partial missingness. *Structural Equation Modeling, 5,* 1-21.

Du Toit, S. H. C., & Mels, G. (2002). Supplementary Notes on Multiple Imputation. Available at http://www.ssicentral.com/lisrel/techdocs/imputation.pdf.

Ehri, L. C. (1998). Grapheme-phoneme knowledge is essential for learning to read words in English. In J. Metsala & L. Ehri (Eds.), *Word recognition in beginning reading* (pp. 3-40). Hillsdale, NJ: Erlbaum.

Elbaum, B., Vaughn, S., Hughes, M., & Moody, S. W. (1999). Grouping practices and reading outcomes for students with disabilities. *Exceptional Children, 65,* 399-415.

Elbaum, B., Vaughn, S., Hughes, M., Moody, S. W., & Schumm, J. S. (1998). *The effect of instructional grouping format on the reading outcomes of students with disabilities: A meta-analytic review.* Document submitted to the Office of Special Education Programs, U.S. Department of Education, Washington, D.C.

Elbaum, B., Vaughn, S., Hughes, M., Moody, S. W., & Schumm, J. S. (2000). How reading outcomes of students with disabilities are related to instructional grouping formats: A meta-analytic review. In R. Gersten, E. P. Schiller, & S. Vaughn (Eds.), *Contemporary Special Education Research: Syntheses of Knowledge Base on Critical Instructional Issues.* Mahwah, N. J.: Erlbaum and Associates.

Foorman, B. R. (2007). Primary prevention in classroom reading instruction. *Teaching Exceptional Children, 39*, 24-30.

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

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

Frith, U. (1981). Experimental approaches to developmental dyslexia: An introduction. *Psychological Research, 43,* 97-109.

Fuchs, L. S., Fuchs, D., & Compton, D. L. (2004). Monitoring early reading development in first grade: word identification fluency versus nonsense word fluency. *Exceptional Children, 71*, 7–22.

Fuchs, L. S., Fuchs, D., Hamlett, C. L., Walz, L., & Germann, G. (1993). Formative evaluation of academic progress: How much growth can we expect? *School Psychology Review, 22,* 27-48.

Fuchs, L. S., Fuchs, D., & Maxwell, S. (1988). The validity of informal reading measures. *Remedial and Special Education, 9*(2), 20-28.

Fuchs, D., Mock, D., Morgan, P. L., & Young, C. L. (2003). Responsiveness-to-intervention: Definitions, evidence, and implications for the learning disabilities construct. *Learning Disabilities Research & Practice, 18,* 157−171.

Fuchs, L. S., Tindal, G., & Deno, S. L. (1984). Methodological issues in curriculum based reading assessment. *Assessment for Effective Intervention, 9,* 191-207.

Gamoran, A., Porter, A. C., Smithson, J., & White, P. A. (1997). Upgrading high school mathematics instruction: Improving learning opportunities for low-achieving, low-income youth. *Educational Evaluation and Policy Analysis*, *19*(4), 325-338.

Gittelman, R., & Feingold, I. (1983). Children with reading disorders: Efficacy of reading remediation. *Journal of Child Psychology and Psychiatry and Allied Disciplines, 24*, 167-191.

Gough, P. B., Juel, C., & Griffith, P. L. (1992). Reading, spelling, and the orthographic cipher. In P. B. Gough (Ed.). *Reading acquisition.* Hillsdale, NJ: Erlbaum.

Greenwald, R., Hedges, L. V., & Laine, R. D. (1996). The effect of school resources on student achievement. *Review of Educational Research, 66*(3), 361-396.

Hanushek, E. A. (1981). Throwing money at schools. *Journal of Policy Analysis and Management, 1,* 19-41.

Hanushek, E. A. (1986). The economics of schooling: Production and efficiency in public schools. *Journal of Economic Literature, 24*(3), 1141-1177.

Hanushek, E. A. (1989). The impact of differential expenditures on school performance. *Educational Researcher, 18*(4), 45-65.

Hanushek, E. A. (1992). The trade-off between child quantity and quality. *Journal of Political Economy, 100,* 84-117.

Hanushek, E. A. (1997). Assessing the effects of school resources on student performance: An update. *Educational Evaluation and Policy Analysis, 19,* 141-164.

Harnischfeger, A., & Wiley, D. E. (1976). The teaching-learning process in elementary schools:A synoptic view. *Curriculum Inquiry*, *6*(1), 5-43.

Hatcher, P. J., Hulme, C., & Snowling, M. J. (2004). Explicit phoneme training combined with phonic reading instruction helps young children at risk of reading failure, *Journal of Child Psychology and Psychiatry, 45*(2), 338-358.

Hattie, J., & Timperley, H. (2007). The power of feedback. *Review of Education Research, 77,* 81-112.

Hasbrouck, J., & Tindal, G. (2006). Oral reading fluency norms: A valuable assessment tool for reading teachers. *The Reading Teacher, 59,* 636-646.

Homan, S.P., Klesius, J. P., & Hite, C. (1993). Effects of repeated readings and nonrepetitive strategies on students' fluency and comprehension. *Journal of Educational Research, 87*, 94-99.

Horn, E., & Walberg, H. (1984). Achievement and interest as functions of quantity and level of instruction. *Journal of Educational Research, 77,* 227-232.

Ikeda, M. J., Gruba, G. G., & Dungan, S. G. (2000). Using curriculum-based measures to establish "benchmarks" predictive of reading comprehension. Johnston, IA: Heartland ADEA 11.

Ikeda, M. J., Tilly, W. D., Stumme, J., Volmer, L., & Allison, R. (1996). Agency-wide implementation of problem solving consultation: Foundations, current implementation, and future directions. *School Psychology Quarterly, 11,* 228−243.

Jimerson, S., Egeland, B., & Teo, A. (1999). A longitudinal study of achievement trajectories: Factors associated with change. *Journal of Educational Psychology, 91*(1), 116-126.

Jöreskog, K. & Sörbom, D. (1996-2001). *LISREL 8: User's Reference Guide.* Lincolnwood, IL: Scientific Software International, Inc.

Jöreskog, K. & Sörbom, D. (2006). *LISREL.8.80 Statistical Softwar*e. Lincolnwood, IL: Scientific Software International, Inc.

Jöreskog, K.G. (2004). *On chi-squares for the independence model and fit measures in LISREL*. Retrieved from http://www.ssicentral.com/lisrel/corner.htm.

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

Juel, C. (1994). *Learning to read and write in elementary school.* New York: Springer-Verlag.

Juel, C., Griffith, P. L., & Gough, P. B. (1986). Acquisition of literacy: A longitudinal study of children in first and second grade. *Journal of Educational Psychology, 78,* 243-255.

Juel, C. & Minden-Cupp, C. (2000). Learning to read words: Linguistic units and instructional strategies. *Reading Research Quarterly, 35,* 458-492.

Keith, T. Z. (2002). Commentary: Academic enablers and school learning. *School Psychology Review, 31,* 394-402.

Keith, T. Z., & Benson, M. J. (1992). Effects of manipulable influences on high school grades across five ethnic groups. *Journal of Educational Research, 86,* 85-93.

Keith, T. Z., & Cool, V. A. (1992). Testing models of school learning: Effects of quality of instruction, motivation, academic coursework, and homework on academic achievement. *School Psychology Quarterly, 7,* 207-226.

Keith, T. Z., Keith, P. B., Quirk, K. J., Sperduto, J., Santillo, S., & Killings, S. (1998). Longitudinal effects of parent involvement on high school grades: Similarities and differences across gender and ethnic groups. *Journal of School Psychology, 36.* 335-363.

Keith, T. Z., & Page, E. B. (1985). Homework works at school: National evidence for policy changes. *School Psychology Review, 14,* 351-359.

Kline, R. B. (1998). *Principles and practices of structural equation modeling*. New York: The Guilford Press.

Klinger, J. K., & Vaughn, S. (1996). Reciprocal teaching of reading comprehension strategies for students with learning disabilities who use English as a second language. *The Elementary School Journal, 96,* 275-293.

Lee, J., Grigg, W., & Donahue, P. (2007). *The nation's report card: Reading 2007* (NCES 2007-496). Washington, DC: National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education.

Leppänen, U., Niemi, P., Aunola, K., & Nurmi, J. (2004). Development of reading skills among preschool and primary school pupils. *Reading Research Quarterly, 39,* 72-93.

Little, R. J., & Rubin, D. B. (2002). *Statistical analyses with missing data.* New York: John Wiley.

Liverman, I. Y, Shankweiler, D., & Liberman, A. M. (1989). The alphabetic principle and learning to read. In D. Shankweiler & I. Y. Liberman (Eds.), *Phonology and reading disability: Solving the reading puzzle* (pp. 1-33). Ann Arbor: University of Michigan Press.

Lovett, M.W., Borden, S. L., DeLuca, T., Lacarenza, L., Benson, N. J., & Brackstone, D. (1994). Treating the core deficits of developmental dyslexia: Evidence of transfer of learning after phonologically- and strategy-based reading training programs. *Developmental Psychology, 30*, 805−822.

Lovett,M.W., Lacerenza, L., Borden, S. L., Frijters, J. C., Steinbach,K. A.,&DePalma,M. (2000). Components of effective remediation for developmental reading disabilities: Combining phonological and strategy-based instruction to improve outcomes. *Journal of Educational Psychology, 92*, 263−283.

Lovett, M., & Steinbach, K. (1997). The effectiveness of remedial programs for reading disabled children of different ages: Does the benefit decrease for older children? *Learning Disability Quarterly, 20,* 189-210.

Lundberg, I., Frost, J., & Peterson, O. (1988). Effects of an extensive program for stimulating phonological awareness in preschool children. *Reading Research Quarterly, 23,* 263-284.

Lou, Y. Abrami, P. C., Spence, J. C., Poulsen, C., Chambers, B., & d"Apollonia, S. (1996). Within-class grouping: A meta-analysis. *Review of Education Research, 66,* 423-458.

Marsh, H. W., Trautwein, U., Lüdtke, O., Köller, O., & Baumert, J. (2005). Academic self-concept, interest, grades, and standardized test scores: Reciprocal effects models of causal ordering. *Child Development, 76*(2), 397-416.

Marston, D. & Magnusson, D. (1985). Implementing curriculum-based measurement in special and regular education settings. *Exceptional Children, 52,* 266-276.

Marston, D., Muyskens, P., Lau, M., & Canter, A. (2003). Problem-solving models for decision making with high-incidence disabilities: The Minneapolis experience. *Learning Disabilities Research & Practice, 18,* 187−200.

Mathes, P. G., Denton, C. A., Fletcher, J. M., Anthony, J. L., Francis, D. J., & Schatschneider, C. (2005). The effects of theoretically different instruction and student characteristics on the skills of struggling readers. *Reading Research Quarterly, 40,* 148–182.

McArdle, J. J. (1988). Dynamic but structural equation modeling of repeated measure data. In J. R. Nesselroade & R. B. Cattell (Eds.), *Handbook of Multivariate Experimental Psychology* (2nd ed., pp. 561-614). New York: Plenum.

McDonald, R. P. & Ho, M-H. R. (2002). Principles and practice in reporting structural equation analyses. *Psychological Methods, 7,* 64-82.

McMaster, K. L., Fuchs, D., Fuchs, L. S., & Compton, D. L. (2005). Responding to nonresponders: An experimental field trial of identification and intervention methods. *Exceptional Children, 71,* 445–463.

Moody, S.W., Vaughn, S., Hughes, M. T., & Fischer, M. (2000). Reading instruction in the resource room: Set up for failure. *Exceptional Children, 66,* 305–316.

Murnane, R. J., & Levy, F. (1996). *Teaching the new basic skills: Principles for educating children to thrive in a changing economy.* New York: The Free Press.

Murray, C. (2003). Risk factors, protective factors, vulnerability, and resilience. *Remedial and Special Education, 24*(1), 16-26.

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

National Research Council (1999). *The changing nature of work: Implications for occupational analysis.* Committee on Techniques for the Enhancement of Human Performance: Occupational Analysis. Commission on Behavioral and Social Sciences and Education. Washington, DC: National Academy Press.

Neisser, U., Boodoo, G., Bouchard, T. J., Boykin, A. W., Brody, N., Eci, S. J., Halpern, D. F., Loehlen, J. C., Perloff, R., Sternberg, R. J., & Urbina, S. (1996). Intelligence: Knowns and unknowns. *American Psychologist, 51*, 77–101.

NICHD-Early Child Care Research Network. (2002). The relation of global first grade classroom environment to structural classroom features and teacher and student behaviors. *The Elementary School Journal, 102*(5), 367-387.

Norris, D. J. (2001). Quality of care offered by providers with differential patterns of workshop participation. *Child and Youth Care Forum 30 (2*): 111–121.

Oakland, T., Black, J. L., Stanford, G., Nussbaum, N. L., & Balise, R. R. (1998). An evaluation of the dyslexia training program: A multisensory method for promoting reading in students with reading disabilities. *Journal of Learning Disabilities, 31,* 140-147.

O'Brien, M., & Peyton, V. (2002). Parenting attitudes and marital intimacy: A longitudinal analysis. *Journal of Family Psychology, 16,* 118–127.

Olson, R. K., Wise, B., Ring, J., & Johnson, M. (1997). Computer-based remedial training in phoneme awareness and phonological decoding: Effects on the posttraining development of word recognition. *Scientific Studies of Reading, 1,* 235-253.

Palmieri, P. A., Marshall, G. N., & Schell, T. L. (2007). Confirmatory factor analysis of posttraumatic stress symptoms in Cambodian refugees. *Journal of Traumatic Stress, 20,* 207-216.

Parkerson, J. A., Lomax, R. G., Schiller, D. P., & Walberg, H. J. (1984). Exploring causal models of educational attainment. *Journal of Educational Psychology, 76.* 638-646.

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

Poncy, B. C., Skinner, C. H., & Axtell, P. K. (2005). An investigation of the reliability and standard error of measurement of words read correctly per minute using curriculum-based measurement. *Journal of Psychoeducational Assessment, 23*(4), 326-338.

Porter, A. C., Kirst, M. W., Osthoff, E. J., Smithson, J. L., & Schneider, S. A. (1993, October). *Reform up close: An analysis of high school mathematics and science classrooms.* Madison, WI: University of Wisconsin Madison.

Pressley, M., Duke, N., Gaskins, I., Fingeret, L., Halliday, J., Hilden, K., Park, Y., Zhang, S., Mohan, L., Reffitt, K., Bogaert, L., Reynolds, J., Golos, D., Solic, K., & Collins, S. (2008). Working with struggling readers: Why I must get beyond the simple view of reading and visions of how it might be done. *Handbook of School Psychology, 4th edition.*

Pressley, M., Wharton-McDonald, R., Allington, R., Block, C. C., Morrow, L., Tracey, D., et al. (2001). A study of effective first-grade literacy instruction. *Scientific Studies of Reading, 5*(1), 35–58.

Rashotte, C. A., & Torgeson, J. K. (1985). Repeated reading and reading fluency in learning disabled children. *Reading Research Quarterly, 20*, 180–188.

Rasinki, T. V., Padak, N. D., McKeon, C. A., Wilcong, L. G., Friedauer, J. A., & Heim, P. (2005). Is reading fluency a key for successful high school reading? *Journal of Adolescent and Adult Literacy, 49,* 22-27.

Raykov, T. & Marcoulides, G.A. (2006). *A First Course in Structural Equation Modeling (2nd Ed.).* Mahwah, NJ: Lawrence Erlbaum Associates.

Rayner, K., Foorman, B. R., Perfetti, C. A., Pesetsky, D., & Seidenberg, M. S. (2001). How psychological science informs the teaching of reading. *Psychological Science in the Public Interest*, *2*(2), 31-74.

Reynolds, A. J. (1992). Comparing measures of parental involvement and their effects on academic achievement. *Early Childhood Research Quarterly, 7*, 441–462.

Reynolds, A. R., & Walberg, H. J. (1992a). A structural model of high school mathematics outcomes. *Journal of Educational Research, 85*, 150-158.

Reynolds, A. R., & Walberg, H. J. (1992b). A process model of mathematics achievement and attitude. *Journal of Research in Mathematics Education, 23,* 306-328.

Reynolds, A. R., & Walberg. H. J. (1992c). A structural model of science achievement and attitude: An extension to high school. *Journal of Educational Psychology, 84,* 371-382.

Roberts, G., Torgesen, J. K., Boardman, A., & Scammacca, N. (2008). Evidenced-based instruction of older students with learning disabilities. *Learning Disabilities Research and Practice, 23,* 63-69.

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

Scammacca, N., Roberts, G., Vaughn, S., Edmonds, M., Wexler, J., Reutebuch, C. K., et al. (2007). *Reading interventions for adolescent struggling readers: A meta-analysis with implications for practice.* Portsmouth, NH: RMC Research Corporation, Center on Instruction.

Scarborough, H. S., & Parker, J. D. (2003). Matthew effects in children with learning disabilities: Development of reading, IQ, and psychosocial problems from grade 2 to grade 8. *Annals of Dyslexia, 53,* 47-71.

Schneider, B., Carnoy, M., Kilpatrick, J., Schmidt, W. H., & Shavelson, R. J. (2007). *Estimating causal effects using experimental and observational designs.* Washington, DC: American Educational Research Association.

Shankweiler, D., Lundquist, E., Katz, L., Stuebing, K. K., Fletcher, J. M., Brady, S., Fowler, A., Dreyer, L. G., Marchione, K. E., Shaywitz, S. E., Shaywitz, B. A. (1999). Comprehension and decoding: Patterns of association in children with reading difficulties. *Scientific Studies of Reading, 3,* 69-94.

Share, D. L. (1995). Phonological recoding and self-teaching: Sine qua non of reading acquisition. *Cognition, 55,* 151-218.

Share, D. L. & Stanovich, K. E. (1995). Cognitive processes in early reading development: Accommodating individual differences into a model of acquisition. *Issues in Education, 1,* 1-57.

Shaywitz, B., Holford, T.R., Holahan, J.M., Fletcher, J.M., Steubing, K.K., Francis, D.J., & Shaywitz, S.E. (1995). A Matthew effect for IQ but not for reading: Results from a longitudinal study of reading. Reading Research Quarterly, 30, 894-906.

Shinn, M. R., Good, R. H., Knutson, N., Tilly, W. D., & Collins, V. L. (1992). Curriculum-bases measurement of oral reading fluency: A confirmatory analysis of its relation to reading. *School Psychology Review, 21,* 459-479.

Shinn, M. R., & Marston, D. (1985). Assessing mildly handicapped, low-achieving, and regular education students: A curriculum-based approach. *Remedial and Special Education, 6*(2), 31-45.

Smithson, J. L., & Porter, A. C. (1994). *Measuring classroom practice: Lessons learned from efforts to describe the enacted curriculum – the Reform Up Close study.* CPRE Research Report Series #31. Madison, WI: University of Wisconsin, Consortium for Policy Research in Education.

Snow, C. E., Burns, M. S., & Griffin, P. (Eds.). (1998). *Preventing reading difficulties in young children.* Washington, D.C.: National Academy Press.

Special Education Elementary Longitudinal Study (SEELS). (2005). *SEELS data documentation and dictionary: Introduction.* Washington, DC: U.S. Office of Special Education Programs (OSEP).

SRI International. (1999). *Special Education Elementary Longitudinal Study (SEELS): Revised timeline and data collection, sample, and analysis plans.* Accessed October 30, 2008 at http://www.seels.net/designdocs/design_contents.htm

Stanovich, K. E. (1984). The interactive-compensatory model of reading: A confluence of developmental, experimental, and educational psychology. *Remedial and Special Education, 5*, 11-19.

Stanovich, K. E. (1986). Matthew effects in reading: Some consequences of individual differences in the acquisition of literacy. *Reading Research Quarterly, 21,* 360-407.

Sugden, D. A. (1989). *Cognitive approaches in special education.* London: The Palmer Press.

Tabachnick, B. G., & Fidell, L. S. (2006). *Using multivariate statistics* (5th ed.). Boston: Allyn & Bacon.

Taylor, B. M., & Pearson, P. D. (2004). Research on learning to read—at school, at home, and in the community. *Elementary School Journal, 105*(2), 167–181.

Taylor, B. M., Pearson, D. P., Clark, K., & Walpole, S. (2000). Effective schools and accomplished teachers: lessons about primary-grade reading instruction in low-income schools. *The Elementary School Journal, 101*(2), 121-165.

Tindal, G., Marston, D., & Deno, S. L. (1983). The reliability of direct and repeated measurement (Research Report No. 109). Minneapolis, MN: University of Minnesota Institute for Research on Learning Disabilities.

Torgesen, J. K. (1985). Memory processes in reading disordered children. *Journal of Learning Disabilities, 18,* 350-357.

Torgesen, J. K. (1999). Phonologically based reading disabilities: Toward an integrated theory of one kind of learning disability. In L. Spear-Swerling & R. J. Sternberg (Eds.), *Perspectives on learning disabilities.* Mahwah, NJ: Erlbaum.

Torgesen, J. K. (2002). The prevention of reading difficulties. *Journal of School Psychology, 40,* 7-26.

Torgesen, J. K. (2004). Preventing Early Reading Failure—and its devastating downward spiral. *American Educator, Fall, 2004.*

Torgesen, J.K. (2006). Recent Discoveries from Research on Remedial Interventions for Children with Dyslexia. In M. Snowling and C. Hulme (Eds.). *The Science of Reading: A Handbook.* Oxford: Blackwell Publishers.

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

Torgesen, J. K., & Hecht, S. A. (1996). Preventing and remediating reading disabilities: Instructional variables that make a difference for special students. In M. F. Graves, P. van den Broek, & B. M. Taylor (Eds.), *The first R: Every child's right to read* (pp. 133-139). New York: Teacher's College Press.

Tunmer, W. E., Herriman, M. L., & Nesdale, A. R. (1988). Metalinguistic abilities and beginning reading. *Reading Research Quarterly, 23,* 134-158.

U.S. Department of Education (2007). *Twenty-Ninth Annual Report to Congress on the Implementation of the Individuals with Disabilities Education Act*, Author, Washington, DC.

Vaughn, S., Fletcher, J. M. Francis, D. J., Denton, C. A., Wanzek, J., Wexler, J., Cirino, P. T., Barth, A. E., Romain, M. A. (2008). Response to intervention with older students with reading difficulties. *Learning and Individual Differences, 18*, 338-345.

Vellutino, F. R., & Scanlon, D. M. (1987). Phonological coding, phonological awareness and reading ability: Evidence from a longitudinal and experimental study. *Merrill-Palmer Quarterly, 33,* 321-363.

Vellutino, F. R., Scanlon, D. M., Sipay, E. R., Small, S. G., Pratt, A., Chen, R., et al. (1996). Cognitive profiles of difficult-to-remediate and readily remediated poor readers: Early interventions as a vehicle for distinguishing betweencognitive andexperiential deficits as basic causes of specific reading disability. *Journal of Educational Psychology, 88,* 601−638.

Wagner, M., Kutash, K., Duchnowski, A. J., Epstein, M. H., & Sumi, W. C. (2005). The children and youth we serve: A national picture of the characteristics of students with emotional disturbances receiving special education. *Journal of Emotional and Behavioral Disorders, 13,* 79-96.

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

Walberg, H. (1981). A psychological theory of educational productivity. In F. Farley and N. Gordon (Eds.), *Psychology and education.* Berkeley, CA: McCutchan.

Walberg, H. J., Fraser, B. J., & Welch, W. W. (1986). A test of a model of educational productivity among senior high school students. *The Journal of Educational Research, 79,* 133-139.

Walberg, H. J. & Shanahan, T. (1983). High school effects on individual students. *Educational Researcher, 12*, 4-9.

Walberg, H. J. &Tsai, S. L. (1985). Correlates of reading achievement and attitude: A national assessment study. *Journal of Educational Research, 78,* 159-167.

Wharton-McDonald, R., Pressley, M., & Hampton, J. M. (1998). Literacy instruction in nine first-grade classrooms: Teacher characteristics and student achievement. *The Elementary School Journal, 99*(2), 101-128.

Williamson, G. L., Appelbaum, M., & Enpanchin, A. (1991). Longitudinal analyses of academic achievement. *Journal of Educational Measurement, 28,* 61-76.

Wise, B., Ring, J., & Olson, R. K. (1999). Training phonological awareness with and without explicit attention to articulation*. Journal of Experimental Child Psychology, 72,* 271−304.

Woodcock, R. W., McGrew, K. S., & Mather, N. (2001). *Woodcock-Johnson III.* Ithasca, IL: Riverside Publishing.

Xue, Y., & Meisels, S. J. (2004). Early literacy instruction and learning in kindergarten: Evidence from the early child-hood longitudinal study – kindergarten class of 1998-1999. *American Educational Research Journal, 41*, 191-229.

Yoon, K. S., Duncan, T., Lee, S. W., Scarloss, B., & Shapley, K. (2007). *Reviewing the evidence on how teacher professional development affects student achievement*. (Issues & Answers Report, REL 2007–No. 033). Washington, DC: U.S. Department of Education, Institute of Education Sciences, National Center for Education Evaluation and Regional Assistance, Regional Educational Laboratory Southwest. Retrieved May 4, 2011 from http://ies.ed.gov/ncee/edlabs

Young, A. R., Beitchman, J. H., Johnson, C., Douglas, L., Atkinson, L., Escobar, M., & Wilson, M. (2002). Young adult academic outcomes in a longitudinal sample of early identified language impaired and control children. *Journal of Child Psychology and Psychiatry, 43,* 635-645.