Academic Kindergarten and Later Academic Success:

The Impact of Direct Instruction

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Abstract

The National Reading Panel recently concluded that pre-literacy and early literacy instruction is appropriate for kindergarten students and an important element of promoting higher achievement in later grades. This paper examines the relationship of receiving the Direct Instruction (DI) kindergarten curriculum, *Reading Mastery*, on students' oral reading fluency in first and second grade. Data from several hundred students in two different schools are analyzed. Achievement was measured using the Dynamic Indicators of Basic Skills (DIBELS). Results indicate that the students who received Direct Instruction kindergarten had significantly higher achievement in early elementary school. These results replicate those found in other studies, providing consistent evidence of the effectiveness of Direct Instruction kindergarten instruction in promoting later academic achievement.

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The Impact of Direct Instruction

A large body of literature has documented the relationship of early reading achievement to later academic accomplishments and economic and social well-being. Students who are poor readers in first grade have substantially higher probabilities of later academic, economic, and social problems than students who achieve at grade level at that time (e.g. Juel, 1988; Lipson & Wixson, 1997; Snider & Tarver, 1987; Wharton-McDonald, Pressley, & Hampston, 1998). These consistent and strong research findings have prompted extensive policy attention to promoting first grade reading achievement. One central concept in the literature is "readiness to learn," the notion that all children should enter elementary school with the skills that prepare them to learn primary level academic content. This preparation is known to be especially important for populations that are judged to be at risk based on the poverty status of their families or other characteristics (Boyer, 1993; Stipek & Ryan, 1997).

In the United States, kindergarten, literally translated as "children's garden," has traditionally been seen as the form of education that helps students transition from home to formal schooling and prepares them for the first grade academic experience. Kindergarten is now part of the public school system and universally available to all students in most jurisdictions in the United States, yet a great deal of variability remains. While definitions of what children should learn in the later grades of elementary schools is relatively standardized (even if the mode of teaching is not), definitions of what children should learn in kindergarten can vary from one jurisdiction to another and even from one school and one teacher within a school to another. A major component of this variation is the extent to which academic learning is emphasized within the curriculum, reflecting a division between those who emphasize minimal academic expectations with a "child-centered" approach and those who emphasize direct teaching of academic skills and content with a "teacher-centered" approach. While recent developments, detailed

below, have resulted in substantially more emphasis on teaching academic skills in kindergarten, the best way to accomplish these goals is still in dispute.

This paper addresses this issue by examining the relationship of kindergarten experiences to reading achievement in first grade and, specifically, the impact of receiving Direct Instruction in kindergarten on later academic achievement. We begin by examining literature regarding academic kindergartens, the nature of the Direct Instruction kindergarten curriculum, and the results of three previous studies of how receiving this curriculum impacts later achievement. We then examine data from two different school districts in the United States, comparing reading achievement in the early elementary grades of students who had Direct Instruction in kindergarten with those that did not. Our results indicate that those who received Direct Instruction in kindergarten had significantly higher achievement in early elementary school, and we discuss the implications of these findings for practitioners and researchers.

Background Literature

Acceptance of the Academic Kindergarten

The role kindergarten should play in the academic experience of children has long been a divisive issue in the field of education. The traditional role of kindergarten for most of the 20th century was as a social and behavioral introduction to the school setting with minimal academic expectations for children. Kindergartens commonly employed a "child-centered" approach that eschewed direct teaching of academic skills and content. In contrast, a "teacher- directed" approach that strives to prepare all students for the academic demands of first grade has gained wide acceptance in recent decades (Gersten, Darch & Gleason, 1988; Clark, 2001).

The teacher-directed approach received a boost with the publication of the National Reading Panel's report on reading instruction in 2000. The report identified five areas of reading instruction that should be part of children's primary grade instruction: phonemic awareness, phonics, fluency, vocabulary, and text comprehension. The panel concluded that phonemic awareness and phonics pre-literacy and early

literacy instruction is completely appropriate for kindergarten students (National Institute of Child Health and Human Development, 2000).

The reading panel report laid the conceptual foundation for the federal Reading First program, which "provides assistance to states and districts to establish scientifically based reading programs for students enrolled in kindergarten through grade three" (U.S. Department of Education, 2008). This large-scale, national program has prompted the widespread dissemination of academic instruction in kindergarten classrooms across the country as a way of preventing academic under-performance in later grades.

Many of the same instructional elements have appeared at the preschool level. The recently published report on the federal Preschool Curriculum Evaluation Research (PCER) initiative evaluated 14 preschool curricula on their impact on students' reading and pre-reading, phonological awareness, early language, early mathematics knowledge, and behavior at the end of pre-kindergarten and kindergarten (National Center for Education Research, 2008). As with the National Reading Panel report, the PCER report may presage a new national initiative focusing on preschool and kindergarten instruction, which increases the practical relevance of analyzing preschool and kindergarten curricula.

The Direct Instruction Model in Kindergarten

Direct Instruction (DI) is a method of teaching that seeks efficiency and effectiveness of instruction through program design, organization of instruction, and positive student-teacher interaction. The DI approach attempts to control all the major variables that impact student learning through the placement and grouping of students into instructional groups, the rate and type of examples presented by the teacher, the specific wording that teachers use to teach specific concepts and skills, the frequency and type of review of material introduced, the assessment of students' mastery of material covered and the responses by teachers to student's attempts to learn the material. Commercially available DI curricula cover the subject areas of reading, language, writing, spelling and mathematics for elementary schools and similar subject areas remedially for middle and secondary schools.

Reading Mastery contains all the elements of effective curricula identified by the national reading panel (Schieffer, Marchand-Martella, Martella, Simonsen, & Waldron-Soler, 2002; Stein, & Kinder, 2004). The kindergarten program first concentrates on oral language skills to ensure that students are familiar with basic directions and to develop students' background knowledge. Students then receive instruction in the reading curriculum, which initially focuses on pre-reading skills (phonemic awareness and phonics). Students start to read words within 30 lessons of reading instruction. The *Reading Mastery* program introduces sounds letters make rather than the letters themselves since decoding does not depend on knowing the names of letters (Engelmann, 2004). [1] Students are taught to blend together the sounds when initially decoding words, and later to read whole words "the fast way." The program concentrates on accuracy of decoding before fluency. Orthographic modifications are gradually removed in the second level of the program. In implementations supported by the National Institute for Direct Instruction, high performing groups of kindergarten students regularly complete the first level of the program and finish the year well into the second level of the program.

Direct Instruction programs are constructed according to a small step design that teaches isolated skills and concepts in separate tracks that are systematically integrated with skills and concepts in other tracks in increasingly sophisticated applications. For this reason, lessons do not focus on a single skill or topic. Instead, only about 10% of a lesson's contents are new. The rest of the lesson is devoted to reviewing and applying skills and concepts that were introduced in previous lessons.

Placement in the program is a critical factor in the program's success. A major goal of DI is to build students' confidence in their ability to learn while they master key skills and concepts. As Gersten, Darch & Gleason note, "perhaps the central image that guided the conceptualization of Direct Instruction kindergarten was the image of students learning new concepts and skills each day, but in such a way that

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[1] Two other Direct Instruction reading programs assume that students already know some of their letter names: *Horizons* (sold through SRA/McGraw-Hill), and *Funnix*, a computer-based adaptation of *Horizons* (sold through Funnix.com). In contrast to *Reading Mastery*, these programs make use of students' knowledge of letter names to teach the sounds letters make when reading (Engelmann, 2000).

they experienced unremitting success" (p. 229). Placement at the point in the program in which students have already mastered material previously covered allows them to experience such success.

The Effectiveness of the Direct Instruction Model in Kindergarten

DI has a long history of proven effectiveness at the kindergarten level (Engelmann and Adams, 1996; Schieffer, 2002). DI originated as a preschool instructional approach and was later applied to other grades and settings. The first levels of the reading, language and mathematics programs were originally designed for kindergarten students.

Research studies on the effectiveness of Reading Mastery with kindergarten students can be divided into two groups: those that measure student achievement directly, and those that measure student achievement indirectly. Research studies that measure kindergarten achievement directly utilize a test that is applied directly to kindergarten students. (For an example, see Marchand-Martella, Martella, Kolts, Mitchell, & Mitchell, 2006.) Research studies that measure kindergarten achievement indirectly utilize a test that is applied to students in higher grades. The indirect analysis compares the performance at later grades of students in the treatment group, who received Direct Instruction in kindergarten, with that of the comparison group, who did not receive the treatment instruction in kindergarten. The indirect analyses should be of most concern to those interested in improving children's long-term academic achievement and eventual economic and social well-being. Two previous studies that used this design are of particular relevance to the current study.

Gersten, Darch & Gleason (1988) – Gersten, Darch & Gleason (1988) studied the effectiveness of DI kindergarten in East St. Louis, a site for project Follow Through, the largest educational experiment in the history of the U.S. (Adams & Engelmann, 1996, p. 67). The national Follow Through program was designed to evaluate the performance of different pedagogical approaches to students in kindergarten through third grade. Each site consisted of a treatment school that received the experimental condition (DI in this case) and a demographically matched comparison school that received the district's traditional curriculum. In 1970 in East St. Louis, some students started school in first grade; other students started

school the same year as kindergartners. The study examined the differential performance of the two cohorts to determine the effects of the year of kindergarten instruction.

The authors found that students who started school in first grade and received three years of instruction with DI significantly outperformed comparison students who received the district's program in mathematics and language, but not reading comprehension or vocabulary, on the Metropolitan Achievement Test (MAT). In contrast, children who started DI in kindergarten significantly outperformed the comparison group when they reached third grade in reading as well as mathematics and language. The cohort that received DI in kindergarten scored near the national median in all measures in third grade. In total reading, they scored at the 43rd percentile. The students who received DI only in first through third grades scored at the 28th percentile. (p. 233)

Gersten, Darch, & Gleason found that these effects were still noticeable at the end of 9th grade. The DI students from both cohorts scored higher in reading, language and mathematics on the California Achievement Test (CAT) than comparison students who received the district's curriculum in the primary grades. In addition, the cohort that received DI in kindergarten significantly outperformed the DI group that started school in first grade. In fact, the disparity between the two groups grew over the six years after the program ended. Ninth grade students who received DI in kindergarten scored at the 40th percentile on average in reading compared to the 23rd percentile for the students who didn't receive an academic kindergarten with DI. (p. 234)

Carlson & Francis (2002) – More recently, Carlson & Francis (2002) examined the effect of Reading Mastery in a large-scale study of reading achievement in the primary grades in Houston. Over 3,000 students from 20 schools received instruction in Reading Mastery in kindergarten in four cohorts from 1997 through 2001 (p. 145). Twenty comparison schools were selected for the study and matched to the treatment schools based on students' demographic characteristics and proximity to the treatment schools. The comparison schools provided instruction using a variety of non-Direct Instruction reading curricula selected by schools individually.

Kindergarten performance was measured using the word identification subtest of the Woodcock-Johnson Mastery test in the first year of the program, 1997-98, the Texas Primary Reading Inventory (TPRI) in 1999-2000 and 2000-01, and the reading subtest of the SAT9 in 2000-01. First and second grade performance was measured using the word reading and comprehension portions of the SAT9. Third grade performance for students who participated in any grade of the implementation in kindergarten through second grade was measured using the Texas Learning Index of the Texas Assessment of Academic Skills (TAAS).

Treatment students consistently outperformed the comparison students in measures administered in kindergarten. The first cohort of students who received instruction in kindergarten in the *Reading Mastery* curriculum scored significantly higher than the comparison group on the Woodcock-Johnson Mastery test in 1998. Pass rates on the letter-sound identification and phonological awareness (blending and onset rime) sections of the TPRI were significantly higher for students who received instruction in kindergarten in the *Reading Mastery* curriculum in 1999-2000 and 2000-01 than for the comparison students. Also in 2000-01, treatment students performed significantly higher on the word reading portion of the SAT9 than the comparison students. In fact, 69% of the treatment students scored above the national norms (the 50th percentile) versus 49% of the comparison students. (p. 152)

Carlson & Francis found that the *Reading Mastery* treatment led to a cumulatively positive effect on student performance. The number of years that students received Direct Instruction was significantly related to both word reading and reading comprehension scores on the TAAS in the third grade. Student performance increased significantly with an increase in the number of years students received the *Reading Mastery* treatment, which underscored the effect of the Direct Instruction implementation in kindergarten. The authors noted that, not only did treatment students perform "at levels significantly higher than comparison students," but also that "students who finish first or second grade with more years of program experience outperform their program peers." (p. 154)

Summary – Taken together, these studies provide consistent evidence that students who had Direct Instruction in their kindergarten years continue to have higher achievement than their peers who have not had such instruction. These differences appeared as late as 9 years after completing kindergarten, with a variety of different assessments, and with large samples of students. To add to this body of literature we examined data from two different school districts.

Recent Data from Two Sites

In the sections below we report analyses of data from two different school districts that illustrate the relationship of Direct Instruction in kindergarten to higher reading achievement in the primary grades. Both districts administered the Dynamic Indicators of Beginning Early Literacy Skills (DIBELS) to all students in Kindergarten and the primary grades. The DIBELS measures are a set of standardized, individually administered indicators of early literacy development that take only about one minute to administer, can be used to regularly monitor the development of both pre-reading and early reading skills, such as those called for by the National Reading Panel, and have very high reliability. All measures result in numeric scores that indicate the number of correct responses given in one minute. Benchmarks have been established to indicate where students should be at the beginning, middle, and end of a school year to be "at risk" of not meeting established literacy goals or at "low risk" of not achieving these goals.

Our analysis focuses on students' DIBELS scores in kindergarten, first and second grade. The kindergarten analysis examines students' level of risk as measured by four different measures: letter naming fluency (LNF), initial sound frequency (ISF), phonemic segmentation fluency (PSF), and nonsense word fluency (NWF). Scores were taken from the last administration in the kindergarten year for each measure (end of the year for LNF, PSF, and NWF and mid-year for ISF). The national benchmarks were used to determine if children's scores placed them "at risk" or "at low risk: of not achieving literacy goals. Then the number of scores placing students either "at risk" or "at low risk" was summed. The resulting scales range from 0 to 4. A score of 4 on the "at risk" measure indicates that a student was at risk on all four measures, while a score of 0 indicates being at risk on none. Similarly, a

score of 4 on the "low risk" measure indicates having low risk on all four measures, and a score of 0 indicates reaching this benchmark on none of the 4 measures.

Beginning in the middle of first grade, students were given the DIBELS measure of Oral Reading Fluency (ORF), a widely used measure of reading rate and accuracy. In this assessment students read a passage aloud for one minute and the number of words read correctly is counted. The ORF measure has been found to have high reliability, strong correlations with comprehension, and to be a strong indicator of general reading competence. Benchmarks based on national norms have also been established (Hasbrouck and Tindal 2006, DIBELS 2008). We examine the proportion of students who are deemed either "at risk" or at "low risk" based on the ORF scores at the middle and end of first grade and second grade.

A Rural Mid-Western District

One of the school systems in our analysis is in a small, rural Midwestern town. The district has four elementary schools. Approximately one-third of the students in our sample were racial-ethnic minorities, primarily Hispanic, and half qualified for receipt of free or reduced lunch. The district began implementing Direct Instruction's *Reading Mastery* in 2004 under the guidance of the National Institute for Direct Instruction, a not-for-profit corporation dedicated to providing school districts with training and support for implementing Direct Instruction. Before that time, the district used a whole language approach and a variety of reading and language programs. In kindergarten these programs included Kid Writing, Scott Foresman, Four Blocks, Sonday System, and Letter People.

Our analysis focuses on over 400 students who began Kindergarten in fall 2003, 2004, or 2005. The cohort that began kindergarten in 2003 had the traditional program during their first year in the system, but DI in later grades. The other two cohorts had Direct Instruction in kindergarten as well as the later grades. Of the 411 students for whom kindergarten data were available, 90 percent were still in the district in first grade, and there were no differences between those who remained and those who left in ethnic minority, free and reduced lunch status or early literacy scores. However, by the end of second grade only about 80 percent of those who began kindergarten in the district were still in attendance. Those

who had left the system were more likely to be receiving free or reduced lunch than those who remained (chi-square = 5.10, df =1, p = .024). Although we report data for second grade, these results should be compared to those for first grade with caution.

Our analysis examines differences in early literacy and later oral reading fluency between those who had DI in kindergarten and those who did not. Table 1 gives descriptive statistics for the DIBELS measures for students in each group and the results of t-tests examining the null hypothesis that there was no difference in the average scores of students who received DI in Kindergarten and those who did not. Panel A of Table 1 reports the results related to the benchmark indicating low risk of meeting literacy goals, and Panel B reports results to being deemed at risk of not meeting goals.

Looking first at Panel A, the results from Kindergarten indicate that students in the whole language kindergarten were significantly more likely to be assessed as being at "low risk." On average, the kindergarteners in the whole language group scored at low-risk on 3 of the 4 measures, while those in the DI kindergartens reached this benchmark on an average of 2.5 measures. The situation reversed dramatically, however, in the primary grades. At all administrations in both first and second grade the students who had received Direct Instruction in kindergarten were significantly more likely than the students who had the whole language kindergarten to be at low risk. In other words, while the kindergarten scores indicated that the students in the whole language program had lower risk for future literacy problems, the reality was different. In first grade those who received DI in kindergarten were doing significantly better, even though all of the students were, by that point, given a DI curriculum.

Substantively similar results appear with the results regarding the "at risk" benchmark, although they are less often statistically significant. Scores from kindergarten indicate that the students who received the whole language curriculum were less often at risk, but the results reverse with the actual reading scores in the primary years. At all testing points the students who had DI in kindergarten were less likely than other students to be labeled "at risk."

A Suburban West Coast District

The data for our second analysis come from a K-12 district in the Pacific Northwest that is on the outskirts of a medium-sized city. The district has five elementary schools and 5700 students in K-12. Our data come from two schools. One adopted the Direct Instruction program, *Reading Mastery*, as the core reading curriculum for the primary grades including kindergarten. The other, termed the Control School, used a traditional curriculum. They also employed a "three tiered" model, occasionally using Direct Instruction for students that teachers felt would benefit from the program, and thus we refer to it as a "mixed program" school.[2] Data were available for 168 students who were enrolled in their respective schools from Kindergarten through second grade. There were no significant differences between the students in the two schools in their race-ethnicity, receipt of free or reduced lunch, or proportion receiving special education services. Table 2 reports descriptive statistics on the DIBELS measures for students in the two schools and results of t-tests testing the hypothesis that the scores are equal. Paralleling Table 1, results for measures regarding "low risk" are in Panel A and those for being "at risk" are in Panel B.

Results are similar to those found with the Midwestern district. The data in Panel A indicate that there were no significant differences between the two groups at the end of kindergarten in the assessment of being at low risk for later literacy problems. However, through both first and second grade, the students in the full DI school had higher ORF scores and were significantly more likely to be assessed as having low risk of not meeting literacy goals. The results in Panel B, regarding the "at risk" status are substantively similar, although not statistically significant. There were no differences in scores on the kindergarten at risk scale, but the students in the mixed program school were more likely than those in the full DI school to be labeled at risk at each point of assessment in first and second grade. By the end of second grade only four percent of the students in the full DI school were at risk of later failure, half the percentage of students who were at risk in mixed program school.

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[2] We were not able to ascertain which students in the mixed program school received extra help with DI, so this could not be included in our analysis. Note, however, that this "leakage" would diminish the probability of having significant results in favor of DI, thus providing a conservative test of DI's impact.

Effect Sizes

Because tests of statistical significance are heavily influenced by sample size, researchers often use measures of effect size to describe substantive results and to compare samples of different sizes. Table 3 summarizes effect sizes for the results. Cohen's d is simply the difference between the means divided by the common standard deviation and is appropriate for the comparison of mean scale scores in kindergarten. Values of .25 are generally considered to be educationally meaningful (Wolf 1986), and both of the comparisons in the Midwestern district meet this criterion. In other words, for this district the difference in early literacy scores favoring students with whole language instruction in kindergarten meets the usual criterion of educationally meaningful.

Odds ratios, another type of effect size, are appropriate for comparing proportions and are reported for the first grade data. The "odds" simply refer to the relative chance of a child falling in one group or another. For instance, for students in the mixed program school in the Pacific Northwest district at the mid-year of first grade, 56% were deemed at low risk of not meeting achievement goals, while 44% did not fall in this category. Thus, the odds that a child in the control school would be at low risk were 56/44 = 1.27, close to even. In the full DI school, 82% of the students at the mid-year point of first grade were deemed at low risk of not meeting achievement goals. Thus, the odds that a child in the treatment school would be at low risk were 82/18 = 4.52, much better than even. The odds ratio is calculated by simply dividing these two values (4.52/1.27 = 3.57). This tells us that the odds that a student in the full DI school would be at low risk are over 3.5 times as great as the odds that a student in the mixed program school would be.

The odds ratios in Panel A are consistently positive and similar in size between the two districts. At all testing periods and for both districts the odds that a student would be at low risk of not reaching established literacy goals were two to three times as great for those receiving Direct Instruction in kindergarten. The results regarding the odds of being at risk of not meeting literacy goals are substantively similar. Students who received DI in kindergarten had substantially lower odds of being at risk of not meeting goals than other students for all testing points and in both districts.

Summary and Discussion

The results from these two districts replicate the findings from the other studies reviewed above. As with the earlier studies, our more contemporary data indicate that students who have Direct Instruction's *Reading Mastery* in kindergarten are significantly more likely to be on track for academic success when in the primary grades. Most of the differences are both statistically and educationally significant. Taken together, the results of these four separate studies in highly different geographical areas, with populations with varying racial-ethnic and poverty status, and spanning several decades provide strong evidence for the superiority of Direct Instruction in preparing students for high achievement throughout their academic career. Our search of the literature revealed no studies that found that other programs consistently demonstrated such positive results in preparing kindergarten children for elementary school. The probability that such significant results in favor of one program would repeatedly occur by chance is extremely small. This consistent pattern of results provides strong evidence that having Direct Instruction's *Reading Mastery* in kindergarten is highly effective in promoting children's academic achievement in first and second grade, putting them on a trajectory for later academic success.

The results from our study raise at least one question that should be addressed by future research: the contrasting results from the DIBELS testing at kindergarten and that in first and second grade. While the kindergarten DIBELS scores indicated that the students in the DI kindergartens were either at the same risk or greater risk of academic difficulties in first grade, the actual results in the primary grades were in the opposite direction, with the DI students being significantly less likely to be at risk of future difficulties. We are unsure why these results occur, but offer three possible explanations. One possible explanation is that the DIBELS tests do not address the elements within the kindergarten *Reading Mastery* program that are especially effective in preparing children to read well in first grade. Another, related, possibility is that the composite measure of the kindergarten scores that we used disguised more subtle differences, and some of the kindergarten measures are more important than others in predicting

later reading achievement. For example, one measure, Letter Naming Fluency, should not be expected to capture the skills acquired by children who have been taught the sounds letters make when reading and not letter names. Third, it is possible that the curricula used in the control schools allowed teachers to more easily "teach to the test" for the various kindergarten measures, while this was much more difficult to do with the measure of oral reading fluency (ORF) used in first and second grade. In addition, the highly structured nature of the DI curriculum probably makes it less likely that a teacher in this program could "teach to the test."[3]

Finally, the results presented in this paper have implications for practitioners and policy makers. They provide additional support for the advocates of academic kindergartens. More importantly, they confirm earlier research that has shown that the carefully constructed and thoroughly field-tested Direct Instruction reading programs are highly effective in these academic kindergartens. Children who are provided with Direct Instruction in kindergarten, even if they begin DI in first grade, are significantly more likely than other students to be on a trajectory toward continued academic success in later years.

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[3] In addition, policies of the National Institute of Direct Instruction, which provided support to the DI schools, strictly prohibit such practices, focusing instead on teaching children the skills that previous research has indicated enhance eventual reading success. While the kindergarten DIBELS results could have suggested that this policy did not help the children in the DI program, the first and second grade results indicate that the policy was, in fact, better for the children in terms of long-term achievement.

Table 1: Early Literacy DIBELS Scores, Students with and without DI in Kindergarten, Mid-Western District

	No DI in Kindergarten		DI in Kindergarten			
A. Low Risk	Mean	s.d.	Mean	s.d.	t	prob.
End of Kindergarten (scale score)	2.98	1.08	2.47	1.08	4.52	<.001
Mid 1st grade (proportion)	0.54	0.50	0.77	0.42	-4.44	<.001
End 1st grade (proportion)	0.52	0.50	0.81	0.39	-5.58	<.001
Mid 2nd grade (proportion)	0.68	0.47	0.79	0.41	-2.04	<.001
End 2nd grade (proportion)	0.58	0.50	0.75	0.44	-3.06	<.001
B. At Risk						
End of Kindergarten (scale score)	0.16	0.48	0.49	0.77	-5.42	<.001
Mid 1st grade (proportion)	0.11	0.31	0.06	0.23	1.63	0.11
End 1st grade (proportion)	0.21	0.41	0.09	0.29	2.86	0.01
Mid 2nd grade (proportion)	0.22	0.41	0.14	0.35	1.62	0.11
End 2nd grade (proportion)	0.25	0.43	0.18	0.39	1.30	0.20

Note: Sample sizes for the two groups were Non-DI: 132 in kindergarten, 119-120 in first grade, and 106-107 in second grade; DI: 279 in kindergarten, 245-247 in first grade, and 226-228 in second grade.

Table 2: Early Literacy DIBELS Scores, Students with and without DI as Core Kindergarten Curriculum, Pacific Northwest District

	Program Mix		Full DI			
A. Low Risk	Mean	s.d.	Mean	s.d.	t	prob.
End of Kindergarten (scale score)	2.91	1.00	2.86	.99	0.38	0.702
Mid 1st grade (proportion)	.56	.50	.82	.39	-3.76	<.001
End 1st grade (proportion)	.62	.49	.86	.35	-3.58	<.001
Mid 2nd grade (proportion)	.70	.46	.83	.38	-1.98	0.049
End 2nd grade (proportion)	.63	.49	.78	.41	-2.18	0.031
B. At Risk						
End of Kindergarten (scale score)	.21	.49	.31	.49	-1.39	0.17
Mid 1st grade (proportion)	.05	.21	.02	.15	0.81	0.42
End 1st grade (proportion)	.06	.24	.01	.11	1.66	0.10
Mid 2nd grade (proportion)	.17	.37	.07	.26	1.89	0.06
End 2nd grade (proportion)	.08	.28	.04	.19	0.13	0.20

Note: Sample sizes for the mixed-program school ranged from 82 to 84, while that for the DI group was 83. Some students in the school labeled "Program Mix" received DI as part of the second or third tier of intervention. In the other school, Direct Instruction was used as the core curriculum for all children.

Table 3: Effect Sizes and Odds Ratios, DIBELS Comparisons, Midwestern and Pacific Northwest District

	Midwestern District		Pacific Northwest District	
A. Low Risk	d	odds ratio	d	odds ratio
Kindergarten	0.48		0.06	
Mid 1st grade		2.93		3.57
End 1st grade		3.94		3.64
Mid 2nd grade		1.75		2.09
End 2nd grade		2.19		2.11
B. At Risk				
Kindergarten	-0.54		-0.22	1.74
Mid 1st grade		0.49		0.49
End 1st grade		0.37		0.19
Mid 2nd grade		0.60		0.39
End 2nd grade		0.68		0.41

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