National Institute for Direct Instruction

A Brief Summary of Research on Direct Instruction

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Direct Instruction is based on over 5 decades of work. The curricular programs are based on extensively formulated and carefully tested theoretical insights and are developed through a painstaking process of research and testing. A great deal of research has shown that they are highly effective in helping all students to increase their levels of achievement. Research also shows that the programs are most effective when they are implemented as designed.

This brief report summarizes some of that work. It has three major sections.[1] The first gives a brief overview of the development of Direct Instruction and its theoretical basis. The second section gives examples of results from a variety of efficacy studies that document the impact that DI has on students' learning, and the third section discusses studies of the implementation of the program and factors that can make it more or less effective. The literature on Direct Instruction is very large. While this summary is believed to be representative of the body of work, interested readers are urged to consult the entire literature.[2]

The Development and Theory of Direct Instruction

The Direct Instruction curricula are based on the insights and work of Siegfried Engelmann.[3] In the 1960s, while working in the field of advertising, he became fascinated with understanding how children learn and the most effective way of helping them retain information. He became convinced that the key issue was the way that children were taught, concluding that if a child fails to learn it is not the fault of the student but instead the fault of the instruction. Underlying this conviction is the realization that children are logical beings, continually trying to make sense of the world around them. Thus, effective instruction is logical in nature, carefully organized and formulated, building on students' previous learning in an unambiguous and cumulative manner. Seeing learning as a cumulative process, mastery of the first element in a learning series helps students more easily master subsequent steps. The result is more efficient and more effective learning. Students learn

[1] This summary is taken from a presentation given at the National Direct Instruction Conference, sponsored by NIFDI and held in July 2014. The presentation was developed by NIFDI's Research Staff: Caitlin Rasplica, Timothy Wood, and Jean Stockard. Stockard was responsible for the material summarized in this document.
[2] NIFDI has a full bibliography of writings on Direct Instruction: http://nifdi.org/research/di-bibliography.
[3] Three books published by NIFDI Press in 2014 examine Engelmann's career and key elements of the Direct Instruction approach: Engelmann, Z. *Successful and Confident Students with Direct Instruction*; Stockard, J. (Ed.) *The Science and Success of Engelmann's Direct Instruction*; and Wood, T. (Ed.). *Engelmann's Direct Instruction: Selected Writings from the Past Half Century*.

more material in a shorter period of time, can learn new material more quickly, and are better able to retain what they have learned.

Engelmann and colleagues first illustrated this approach in a preschool setting at the University of Illinois, showing how an academically oriented preschool could result in disadvantaged children catching up with their more advantaged peers with a relatively small amount of well-designed instruction each day. From this work Engelmann and colleagues developed programs of teaching language skills, reading and mathematics. They extended the work to encompass instruction for students with special needs such as the hard of hearing, students with autism, those with English as a second language and seriously disruptive students. The programs are very carefully developed, involving extensive field work and testing of the instructional sequences. If the programs do not work they are revised and retested in a lengthy process not used with other curricula.

One of the hallmarks of Direct Instruction is its attention to consistent positive reinforcement for students – not just through teachers' praise for students' learning but also through the structure of the programs. Because students are constantly learning new material they are intrinsically reinforced for their scholarly efforts. In other words, in Direct Instruction programs students learn more and also develop more positive views of their academic abilities.

The first large scale test of Direct Instruction programs occurred with Project Follow, a massive research project sponsored by the federal government from 1968 through the 1970s. The project was designed to determine the most effective method for teaching at-risk children. Over 20 instructional programs were tested, involving thousands of students across the country in a wide variety of urban and rural settings. A wide variety of programs were used, most of which remain in one form or another today. Extraordinary efforts were devoted to ensuring that the settings had similar supports and that the data analysis was scientifically valid.

The results were clear-cut.[4] The average achievement of the Direct Instruction students was far higher than those in any of the other approaches. Figure 1 shows the results on one of the outcome measures – the Metropolitan Achievement Test. It shows how the DI students had much higher average scores than those in the other groups in all the subjects tested. Similar results occurred with all of the measures of achievement. In addition, the DI students showed greater gains in non-cognitive areas, having more positive self-assessments than those in any other program, including those that were specifically focused on trying to enhance students' self-esteem.

The Efficacy of Direct Instruction Programs – Example Studies

Dozens, if not hundreds, of studies since have replicated the results of Project Follow-Through, finding that Direct Instruction programs are more successful than any

[4] Becker, W.C. & Engelmann, S. (1996) Sponsor Findings from Project Follow Through. Effective School Practices, 15 (1), 33-42; reprinted as chapter 12 in Wood, T. (Ed.) (2014) *Engelmann's Direct Instruction: Selected Writings from the Past Half Century*. Eugene, OR: NIFDI Press.

others in raising students' achievement. One method that is commonly used to summarize large literatures is quantitative meta-analysis; and several meta-analyses, as well as systematic reviews, have examined the literature on Direct Instruction's efficacy.[5]

In 2009, as part of a large scale review of studies in the field of education, John Hattie conducted a "meta-analysis of meta-analyses," systematically looking at the results of 4 quantitative summaries. In total, these meta-analyses looked at 304 studies, examined almost 600 effects, and involved over 40,000 students. The average effect size across all of the comparisons with Direct Instruction was .59. (Effect sizes are numbers used to compare results from a wide variety of studies, translating differences between study groups into a standard metric. Traditionally effect sizes of .25 or larger have been seen as "educationally important.") In addition, Hattie was able to calculate effects for various sub-populations. He reported

> The effects of Direct Instruction are similar for regular (d=0.99), and special education and lower ability students (d=0.86), higher for reading (d=0.89) than for mathematics (d=0.50), similar for the more low-level word attack (d=0.64) and also for high-level comprehension (d=0.54), and similar for elementary and high school students.[6]

While effect sizes can be interpreted in standard deviation units, users sometimes find a translation into an "improvement index" given as percentiles as somewhat easier to understand.[7] Given the average effect size of .59 reported by Hattie, one would expect that after receiving instruction with DI a student who was scoring at the national average (the 50th percentile) would score at the 73rd percentile. One scoring at only the 30th percentile would be expected to score at the 53rd percentile, above the national average. It should be remembered that these effects are combined across all studies. If the program were well implemented one could expect even higher effects.

This section presents examples of findings that reflect Hattie's summary. Several key themes emerge from this discussion: DI students have higher achievement and stronger rates of learning than those in other programs. The positive results for DI occur across different geographic settings. They occur across students with different characteristics and in studies with different methodologies. The impact of DI is long-lasting and cumulative in nature. Examples related to each of these themes are given below.

Positive Results in Different Settings

Figure 2 shows results from a study of students' math achievement in an east coast city in the United States. The district was committed to raising student achievement and put

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[5] Coughlin, C. (2014).Outcomes of Engelman's Direct Instruction: Research Syntheses. pp. 26-53 in Stockard, J. (ed.) *The Science and Success of Engelmann's Direct Instruction*. Eugene, OR: NIFDI Press.

[6] Hattie, John A.C. (2009). *Visible Learning: A Synthesis of Over 800 Meta-Analyses Relating to Achievement*. London and New York: Routledge; pp. 206-7.

[7] The improvement index is calculated by transforming percentiles into NCE scores (with a mean of 50 and s.d. of 21.06; using the effect size to estimate the change in the mean; and then translating this new mean back into a percentile.)

extensive resources into supporting schools toward that aim.[8] Some of the schools chose the DI mathematics curriculum, while the others used a variety of curricula. Data were available for a six year period and the analysis controlled for demographic factors. The results were clear-cut. On average, at the start of the six year period, before the intervention began, students in the DI schools had lower mathematics achievement scores on the Comprehensive Test of Basic Skills than those in other schools. However, six years later, their scores were significantly higher. These results appeared with both measures of computational skills and those associated with the more theoretical "concepts and applications."

The next example involves reading achievement in two schools in a suburban west coast district.[9] The schools were only a few miles apart and had students with very similar demographic characteristics. One school implemented Direct Instruction, using a full immersion model where those in need of additional assistance (e.g. special education students) were given additional time in their DI reading program. The other school used the basal reading program *Open Court* and a variety of additional reading instructional material for special education students. The curriculum based assessment, DIBELS, was used to measure students' reading skills.

At the beginning of kindergarten the students in the two schools had very similar DIBELS scores. But by first grade, those in the DI school had significantly higher scores. These differences continued through the end of data collection (the end of the primary grades). Figure 3 shows the percentage of students meeting the established DIBELS benchmark at the middle of first grade for both the total group and special education students in each school. The DI students had significantly higher scores than the Open Court students. Note especially that the special education students in the DI school had scores that were very close to those of the general education Open Court students. Similar results appeared until the end of data collection.

Figure 4 summarizes results from a study of the use of Funnix, a computer-based Direct Instruction reading program, with students in a head start program in the southern United States.[10] The Head Start students were randomly assigned to their regular language arts curriculum or to the use of Funnix. Careful attention was paid to ensuring that the students in the two groups had equivalent instructional time. As shown in Figure 4, a variety of assessments were used, and the results were similar across all of the tests. At the end of

[8]Stockard, J. (2008) *Improving Elementary Level Mathematics Achievement in a Large Urban District: The Effects of NIFDI-Supported Implementation of Direct Instruction in the Baltimore City Public School System*, NIFDI Technical Report 2008-3; and Stockard, J. (2010). Improving Elementary Level Mathematics Achievement in a Large Urban District: The Effects of Direct Instruction, *Journal of Direct Instruction, 10* (Winter): 1-16.

[9] Stockard, J. (2008). *Reading Achievement in a Direct Instruction School and a 'Three Tier' Curriculum School*, NIFDI Technical Report 2008-5.

[10] Stockard, J. (2009). *Promoting Early Literacy of Preschool Children: A Study of the Effectiveness of Funnix Beginning Reading*, NIFDI Technical Report 2009-1; Stockard, J. (2010). Promoting Early Literacy of Preschool Children: A Study of the Effectiveness of Funnix Beginning Reading, *Journal of Direct Instruction, 10* (Winter, 2010):29-48.

the school year students who received the DI program had higher levels of achievement and were better prepared for entering elementary school than the students in the traditional curriculum.

Figures 5 to 7 show results from a set of charter schools in the Portland, Oregon, area.[11] Data on students' scores on the mathematics and reading portions of the Stanford Achievement Test (SAT) were available from three academic years. Results across subjects and years were very consistent. At the beginning of kindergarten the students had scores that were slightly lower than the national average. But by the end of kindergarten the students scored well above the national average. The students continued to have scores that were well above the national average on the SAT through later years. They also had scores on state assessments that were significantly higher than those of other students within the state.

The final example in this section comes from Liberty School, an elementary school in Monrovia, Liberia.[12] Like other schools in this area of the world, Liberty school, has limited supplies, poor infrastructure, and serves students from very impoverished backgrounds. Direct Instruction materials and consulting were donated to the school by a group of American consultants. A few years later, DIBELS data were collected from Liberty school, from a comparison Liberian school that did not use DI programs, and from a set of Midwestern schools, some of which used DI programs. Data in Figure 8 show the average Oral Reading Fluency (ORF) scores of students at each grade at the three sites. At each grade the Liberty students had scores that were far above those of students in the other Liberian school. Even more impressive, the scores of the Liberty students were indistinguishable from the average scores of the Midwestern students by grades 5 and 6.

Similar Results with Different Study and Student Characteristics

Significant results in favor of Direct Instruction appear in studies employing a variety of characteristics. A summary of relevant comparisons is in Figures 9 and 10, all using "effect sizes." The data come from a set of analyses of data from a wide range of schools and using a variety of data analysis techniques.[13] Figure 9 compares results obtained for studies involving students with different characteristics. Educationally important results, of similar magnitude appeared in studies with different proportions of students in poverty, of different racial-ethnic groups, and with different English language abilities. Figure 10 gives a similar comparison for studies with different methodological characteristics. Again,

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[11] Arthur, C. & Stockard, J. (2014). *An Analysis of Achievement Scores of Arthur Academy Schools, 2007-2013*, NIFDI technical report 2014-2. Eugene, OR: NIFDI.

[12] *Direct Instruction and Reading in Africa: A Comparison of DIBELS Scores of a DI School in Liberia, a Comparison Liberian School, and US Schools*, NIFDI Technical Report 2010-1; Direct Instruction in Africa, *DI News*, Summer, 2010. (by Tamara Bressi, Rob Bressi, Kurt Engelmann, Amy Johnston, Jerry Silbert, and Jean Stockard).

[13] Stockard, J. (2014). Merging the Accountability and Scientific Research Requirements of the No Child Left Behind Act: Using Cohort Control Groups" *Quality and Quantity: International Journal of Methodology*, 47(2013), pp. 2225-2257, available on-line, December, 2011.

educationally important results occurred in studies with different designs, with different types of assessments, in both larger and smaller schools, and in studies with different sample sizes.[14]

Positive results of Direct Instruction appear among older students as well as younger students.[15] Figure 11 shows the results of a study that examined growth of reading skills among fourth grade students in a Midwestern school.[16] All of the students were high achieving and from middle class backgrounds. At the beginning of the school year they were randomly assigned to receive the DI reading program, Reading Mastery, or to continue in the school's usual program (Scott Foresman). Changes in reading skills over time were assessed with AIMSWeb, a curriculum based measure. In the fall the students in the two groups had very similar AIMSWeb scores. However, by the end of the school year the DI fourth graders had significantly higher scores. The results occurred with measures of both fluency and comprehension.

Another example of results with upper grade students comes from mathematics students in a fifth grade self-contained classroom.[17] A teacher/researcher implemented the DI program *Connecting Math Concepts (CMC)* with his fifth graders in the middle of the school year. The Easy CBM Mathematics assessment was used to measure growth in mathematics skills. Changes in average scores of the DI students and those of students in the nation as a whole are shown in Figure 13. At the winter testing, before starting CMC, the DI students had lower scores than others in the nation. However, by the spring, the DI students had average scores that were significantly higher than those in the nation.

The Impact of DI is Long-Lasting

A major concern among educators who work with students from deprived settings is the issue of maintaining achievement gains through the higher grades. While disadvantaged students may catch up with their peers in the elementary grades, the academic gains can dissipate as they get older, a phenomenon sometimes called the "fourth grade slump." However, evidence shows that Direct Instruction students from disadvantaged backgrounds don't experience this slump. Instead, with continued instruction in DI, continue their high

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[14] The term CC in Figure 10 refers to a cohort control group design and CCHC refers to cohort control with historical comparison design. See Stockard, J. (2014). Merging the Accountability and Scientific Research Requirements of the No Child Left Behind Act: Using Cohort Control Groups" *Quality and Quantity: International Journal of Methodology*, 47(2013), pp. 2225-2257, available on-line, December, 2011 for more details on design.

[15] A number of the effects used in calculations in Figures 9 and 10 were calculated from data on older students.

[16] Stockard, J. (2010). *Fourth Graders' Growth in Reading Comprehension and Fluency: A Pretest-Posttest Randomized Control Study Comparing Reading Mastery and Scott Foresman Basal Reading Program*, NIFDI Technical Report 2010-3.

[17] Skarr, A. (2013) *Effects of using a scientifically and evidence-based mathematics curriculum to teach fifth grade math skills to a heterogeneous group of fifth graders in a parochial, Catholic school*, by Adam Skarr (2013), Masters of Education Capstone Paper, University of Portland, Portland, Oregon. Available in the NIFDI Data base

levels of achievement are maintained and can continue to increase over time. These results appear with both reading and math.

Data in Figures 14 and 15 are from students in an inner-city east coast city and include only those who were in the same school from the end of first grade to the end of fifth grade. Over the five year period some of the students were in schools that only used DI, some used a variety of non-DI reading curricula, and some used only Open Court. At the end of first grade the DI students had both vocabulary and comprehension scores that were markedly lower than the other students. By the end of fifth grade, however, their scores were markedly higher than the other students and surpassed national averages.[18]

Figure 16 displays data on changes from first to fifth grade in mathematics achievement using the same sample used for the reading analysis described directly above.[19] Two groups of comparison students are used. One involves the entire group of other schools and the other is a more limited sample of schools with similar socio-demographic characteristics. Two types of CTBS scores are examined: computations and "concepts and applications." The results differed slightly between the two measures. With the measure of computational skills, both the DI students and the reduced sample of control students had greater gains over time than the full group of students in the district. On the more theoretical measure of concepts and applications the DI students had significantly stronger gains from first to fifth grade than both groups of comparison students.

Studies of students who were involved in the Follow Through study found that those exposed to DI in the primary grades were significantly more likely to do well in high school and to continue on to higher education. Similar results appeared in a recent long-term follow-up of students in an Oregon school district, as illustrated in Figure 17. The data involve students from one very high poverty elementary school in a west coast city, examining differences in high school experiences of students from two different groups. One group includes students who were exposed to DI beginning in kindergarten, while the other includes students who had no exposure to DI until grade 2 or 3. There were no differences between these groups in socio-demographic characteristics. However, the students differed markedly in their high school experiences. In high school the students who had DI throughout their primary years were significantly more likely to have taken AP classes or college entrance exams, to have taken mathematics classes required for college admission and to rank much higher in their high school graduating class.

Direct Instruction appears to give students a running start at success. This appears to happen from students' cumulatively greater exposure to vocabulary and knowledge. Because DI students have greater reading fluency and higher comprehension they can read

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[18] Stockard, J. (2008). *The Long-Term Impact of NIFDI-Supported Implementation of Direct Instruction on Reading Achievement: An Analysis of Fifth Graders in the Baltimore City Public School System*, NIFDI Technical Report 2008-2; and Stockard, J. (2010). Promoting Reading Achievement and Countering the 'Fourth-Grade Slump': The Impact of Direct Instruction on Reading Achievement in Fifth Grade, *Journal of Education for Students Placed at Risk, 15* (August, 2010): 218-240.

[19] Stockard, J. (2010). Improving Elementary Level Mathematics Achievement in a Large Urban District: The Effects of Direct Instruction, *Journal of Direct Instruction, 10* (Winter, 2010): 1-16.

more and understand more material in a given period of time than other students. Such "reading volume" is often cited as an important element in future academic success. Figure 18 summarizes this impact, using estimates of the volume of words to which students can be exposed. It compares a group of students who had DI from the start of schooling in kindergarten (full implementation), to those who began the program in later grades (partial implementation). (Clearly differences would be greater if the comparison were to students with no DI.) At each grade level the students with more DI exposure would be expected to have significantly more exposure to the written word. Over the course of the primary grades it is estimated that students exposed to DI since the start of kindergarten would be exposed to thousands more words than those who began the program in first grade.

The Importance of Strong Implementation Fidelity in Creating Success

Several researchers have examined factors that can influence why some implementations of Direct Instruction are more successful than others. The clear conclusion appears to be that DI works best when it is implemented as designed – in other words, when teachers and administrators carefully follow the procedures and programs and when students fully master each element of the lessons and make regular progress through the programs. Research also shows that it takes time for teachers to learn to do DI well and for schools to fully implement the program. The strongest results also appear when students begin their work with DI in kindergarten. Some of the studies that illustrate these elements are summarized in this section.

Figures 19 and 20 illustrate the impact of maintaining high fidelity to the tenets of the DI model.[20] The data come from the east coast inner city site used in earlier figures and compare scores on reading subtests of the CTBS data for three groups: two groups of DI schools and a group of schools that used the Open Court curriculum. One of the DI groups (NIFDI) had strong adherence to the tenets of the DI model, while the other (ODI) was less strict about adherence to the model. The results in the two figures show the percentile of the average first grader in the first year in which DI was implemented and after 7 years of implementation. Scores were statistically adjusted to control for various differences in socio-demographic characteristics of the schools. The results are clear. With both vocabulary and comprehension, the changes over time were greater within the schools with greater adherence to the model – that is, with higher fidelity.

One element of a successful implementation is giving teachers time to practice their lessons. This helps them become as fluent as possible in their presentations, a crucial element in making learning effective and efficient. Figures 21 and 22 illustrate the importance of this element in the success of an implementation. The data come from one

[20] Stockard, J. (2008). *Improving First Grade Reading Achievement in a Large Urban District: The Effects of NIFDI-Supported Implementation in the Baltimore City Public School System*, NIFDI Technical Report 2008-1; and Stockard, J. (2011). Direct Instruction and First Grade Reading Achievement: The Role of Technical Support and Time of Implementation, *Journal of Direct Instruction*, 11 (1, 2011), 31-50.

Midwestern school.[21] When the school first implemented DI the principal resisted giving teachers time to practice their lessons. However, after two years he changed his mind and scheduled practice time (and potentially also promoted other ways to have high fidelity). The data in Figures 21 and 22 compare the growth in DIBELS scores of students in three cohorts at this school: one with no DI exposure, one where the teachers did not practice, called "partial implementation," and a third, called "full implementation," where the principal supported a full implementation of the model, including time for practicing lessons. Figure 21 shows changes in nonsense word fluency (NWF) from the spring of kindergarten to the start of second grade. Figure 22 shows changes in oral reading fluency (measured in lexiles, a cumulative reading score) from the middle of first grade to the start of second grade. In both cases the results are clear. While both cohorts of DI students did better than those without DI, the strongest growth occurred for the DI cohort with full exposure to the model. The students with full exposure to the model were well on their way to reading success by the middle of first grade and at a point that the other students would, on average, only reach several months later.

Another key element of successful implementation is ensuring that students make regular progress through the curriculum at mastery – in other words, that they learn each element of the curriculum thoroughly and that they make steady and regular progress. Data from three different sites (Texas, Colorado, and an inner city) show a strong relationship between students' progress through the curriculum at mastery and their achievement scores.[22] Figure 23 shows the percentage of students who scored at the proficient level on their state assessment for those who were at or near grade level in their DI programs in math and reading and for those who were further behind. Figure 24 shows the percentage of students in these groups who scored at or above the national average on the MAP. In both cases students who were making adequate lesson progress were much more likely to score at the proficient level and to be above the national mean.

Figure 25 summarizes the results of a statistical analysis designed to estimate the "value added" to students assessment scores by their lesson progress at mastery. Students' previous achievement measures are usually a very strong predictor of subsequent scores on achievement tests, so in these analyses, their levels of prior achievement were statistically controlled. The results indicated that students' cumulative progress through their DI reading and math programs at mastery provided significant "value added" to their earlier achievement scores. The data in Figure 25 are effect sizes. All are positive and all but one is greater than .20. Most of the individual estimates of value added were statistically significant, even with relatively small samples and strong controls. In other words, students' progress in their DI programs added significantly to their achievement scores beyond what they would be expected to score given their earlier performance on the assessment. The

[21] *Increasing Reading Skills in Rural Districts: A Study of Three Midwestern Districts*, NIFDI Technical Report 2010-3.

[22] Stockard, J. (2014). *The Relationship between Lesson Progress in Direct Instruction Programs and Student Test Performance*, NIFDI Technical Report – 2014-1. Eugene, OR: NIFDI.

findings are especially noteworthy given the replication of results across three different sites and several grade levels.

Teaching with Direct Instruction is technical in nature and takes time to learn to do well. It also takes time for schools, as a whole, to adjust to a new system. Thus, it is not surprising that achievement scores tend to increase over time as DI becomes institutionalized or "stabilized" within a school and teachers become more skilled. This pattern is illustrated in Figure 26, using data from a very high poverty school in rural North Carolina.[23] The line in the graph shows the percentage of students who scored at the proficient level or higher on the state assessment from before DI was implemented through five years later. Note that there were very strong changes over time. Note also, however, that the strongest increases came four years after implementation as the teachers had time to thoroughly learn the program and develop their expertise. The authors of this study explicitly noted the importance of assessing the impact of such an intervention over an extended period of time and not necessarily expected immediate results.

The largest achievement gains occur for students who begin DI in the earliest grades, especially for those who start at kindergarten. These results first appeared in the Follow Through data and have been replicated many times since. Figures 27 and 28 illustrate this phenomenon with data from a group of three Midwestern school districts with a large population of Hispanic students.[24] Data were available on DIBELS scores for students over a period of years and allow the comparison of students who began DI in Kindergarten with those who started later in their careers and to the national population. Data are given in Figure 27 for nonsense word fluency (NWF) and in Figure 28 for oral word fluency (ORF) lexiles. The results are identical. Students who began the program in kindergarten had higher scores.

Figure 29 reports data from one of the Midwestern districts on the percentage of fourth grade students who scored at the proficient level or higher on the state assessment. Data were available for those with no exposure to DI, those with partial exposure, and those exposed since kindergarten. Paralleling results in Figures 27 and 28, those with the longest exposure to DI were most likely to score at the proficient level or higher.

Figure 30 provides an alternative way of examining the importance of beginning exposure as early as possible. This figure summarizes data on the effect size associated with having DI and compares the effects for studies in which students began the program in kindergarten with those when the students began in later grades.[25] While the average effect

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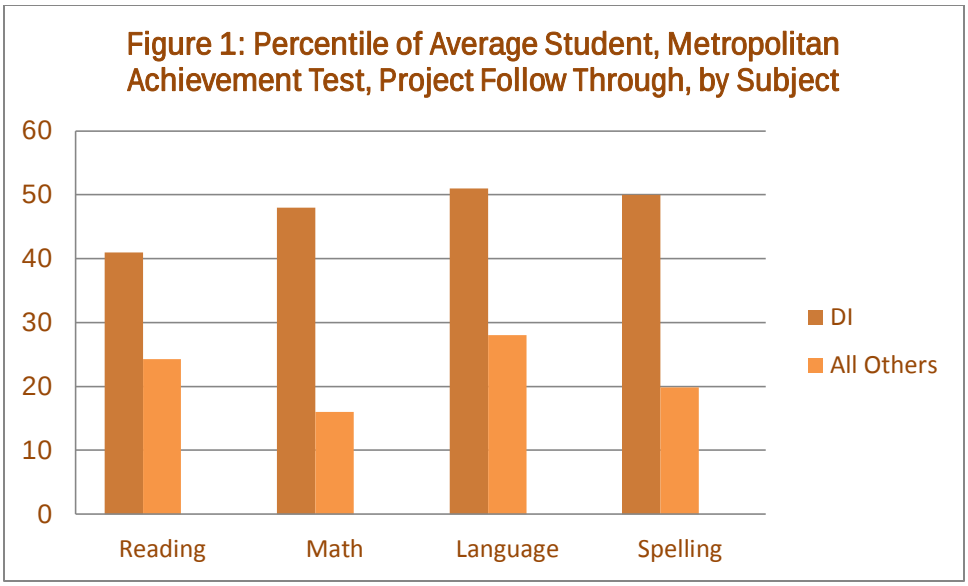
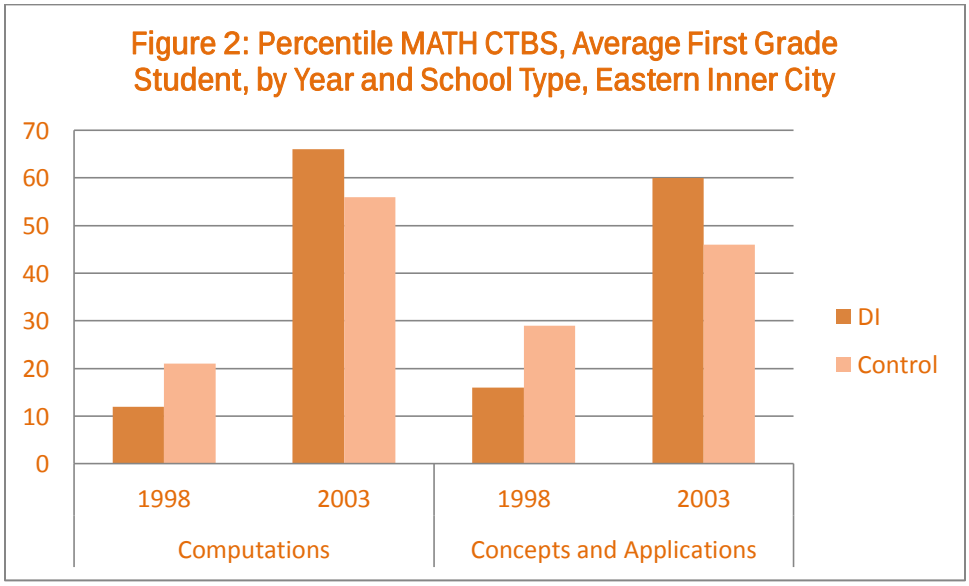
23 Vitale, M. & Joseph, B. (2008. Broadening the institutional value of Direct Instruction Implemented in a low-SES elementary school: Implications for scale-up and school reform. Journal of Direct Instruction, 8: 1-18.
[24] Stockard, J. (2008). *Kindergarten and Later Academic Success: The Impact of Direct Instruction*, NIFDI Technical Report 2008-7; Stockard, J. (2011).Increasing Reading Skills in Rural Areas: An Analysis of Three School Districts, *Journal of Research in Rural Education*, 26 (8, 2011), pp. 1-19.
[25] Calculated from data in Merging the Accountability and Scientific Research Requirements of the No Child Left Behind Act: Using Cohort Control Groups" *Quality and Quantity: International Journal of Methodology*, 47(2013), pp. 2225-2257, available on-line, December, 2011.

for both groups of studies is well beyond the level used to denote educational importance (.25), the effect for those who started in K is substantially larger.

Summary

A key assumption underlies Direct Instruction: When students fail to learn it is not the fault of the student, but the fault of the instruction. Thus it is crucial that the instruction be as clear and explicit as possible. The Direct Instruction guidelines for developing clear and explicit instruction have been thoroughly formulated theoretically and tested empirically. The various DI curricular programs are developed using these guidelines and, in the process, undergo extensive research and testing. Once programs have been developed additional tests of their efficacy consistently indicate that students using DI have higher achievement than those using other programs. These results appear in a wide variety of settings, with students from many different backgrounds, with a wide variety of research designs, and with different assessment methods. The impact of DI on students' learning is long-lasting and cumulative. Research also indicates that the best results appear when DI is implemented as it was designed, fully following the guidelines of the developer. Learning to teach with DI takes time and practice, and the best results appear after schools and teachers have fully learned the model. The best results for students appear when they begin the program in the kindergarten years, thus giving them a running start at success.





Note: 1998 was the year before interventions began. 2003 was the fifth year of interventions. Computations and Concepts and Applications are the two sub-tests of the Comprehensive Test of Basic Skills (CTBS).

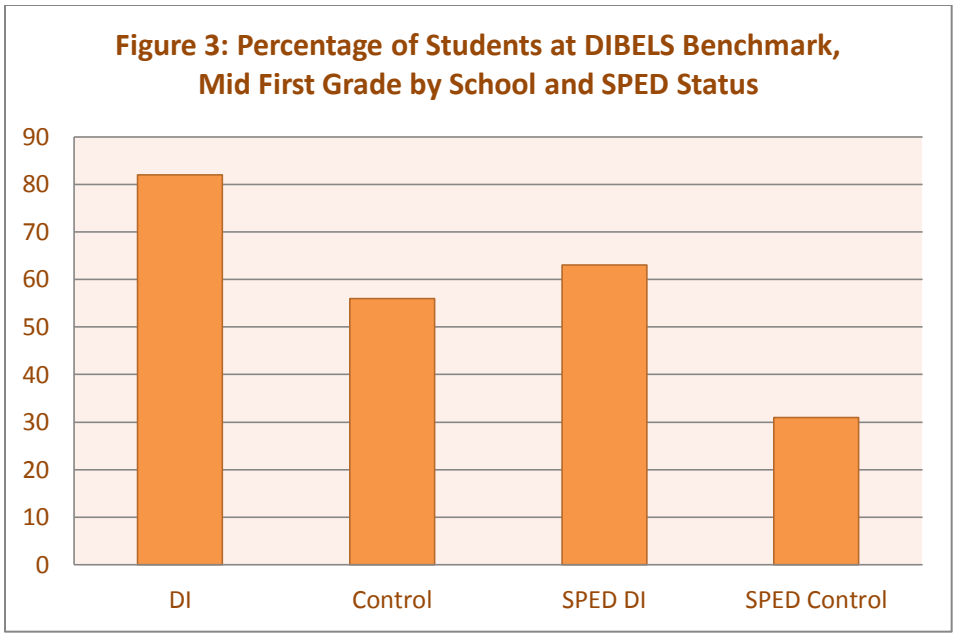


Figure 3: Percentage of Students at DIBELS Benchmark, Mid First Grade by School and SPED Status
90
80
70
60
50
40
30
20
10
0
DI
Control
SPED DI
SPED Control

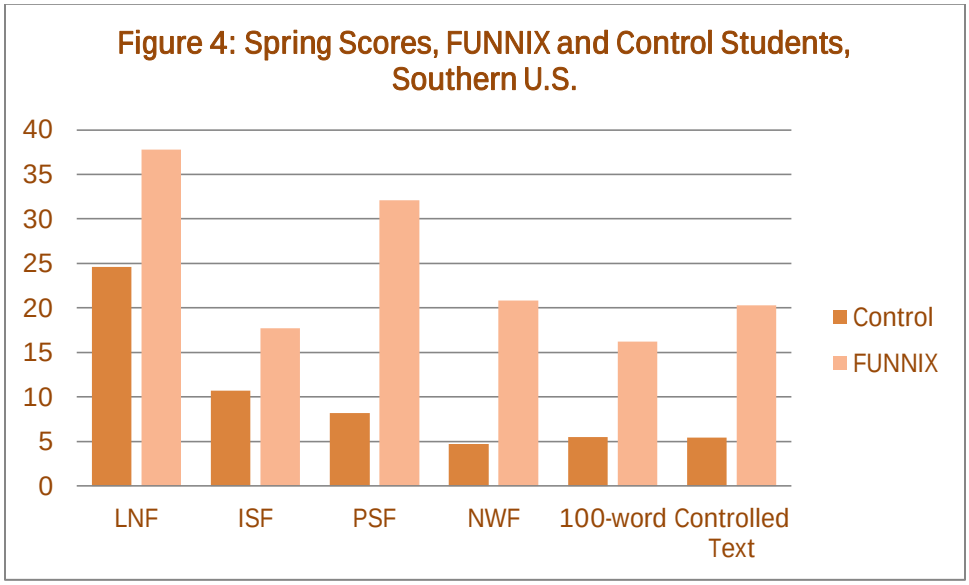
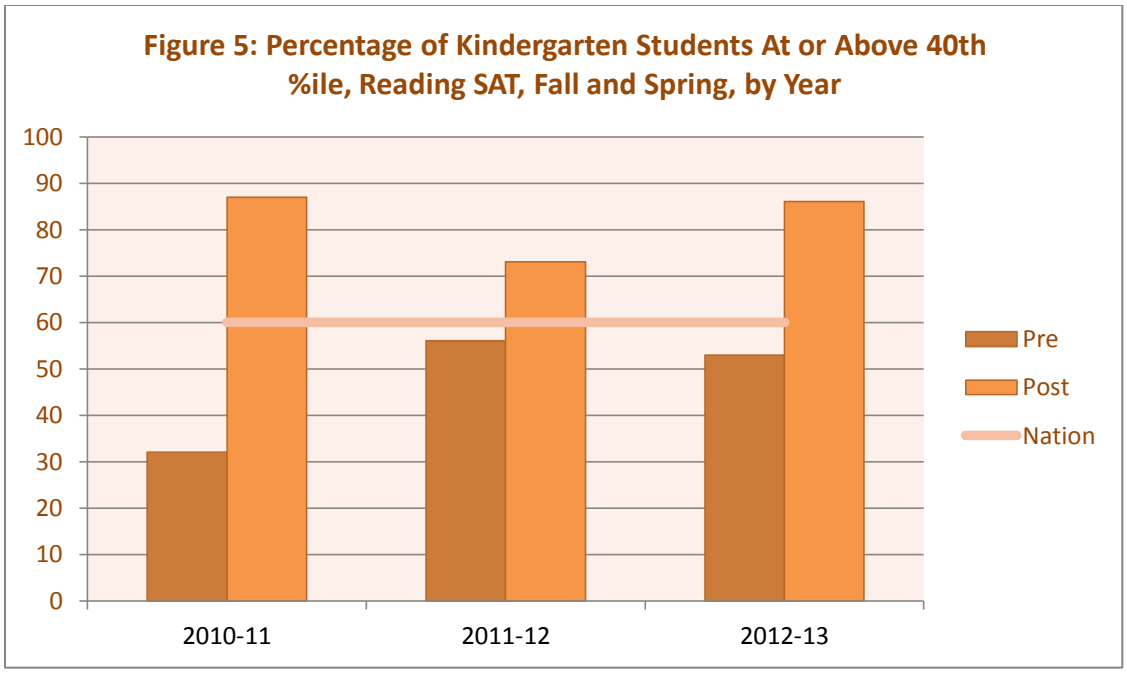
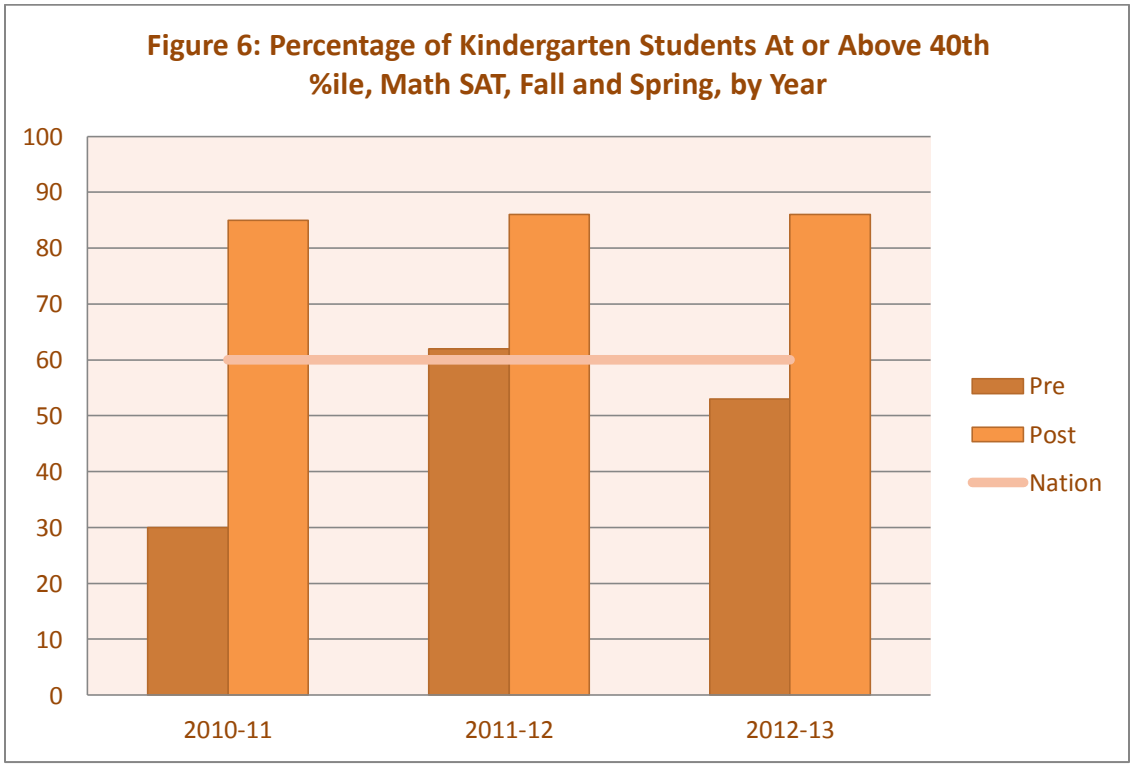


Figure 4: Spring Scores, FUNNIX and Control Students, Southern U.S.
40
35
30
25
20
15
10
5
0
LNF
ISF
PSF
NWF
100-word Controlled Text
Control
FUNNIX



Note: The lines in this graph and in Figures 6 and 7 represent the level at which the average student in the nation scored. For instance, 60% of the students in the nation scored at the 40th percentile or higher (the data in Figures 5 and 6); 20% of the students in the nation scored at the 80th percentile or higher (the data in Figure 7).



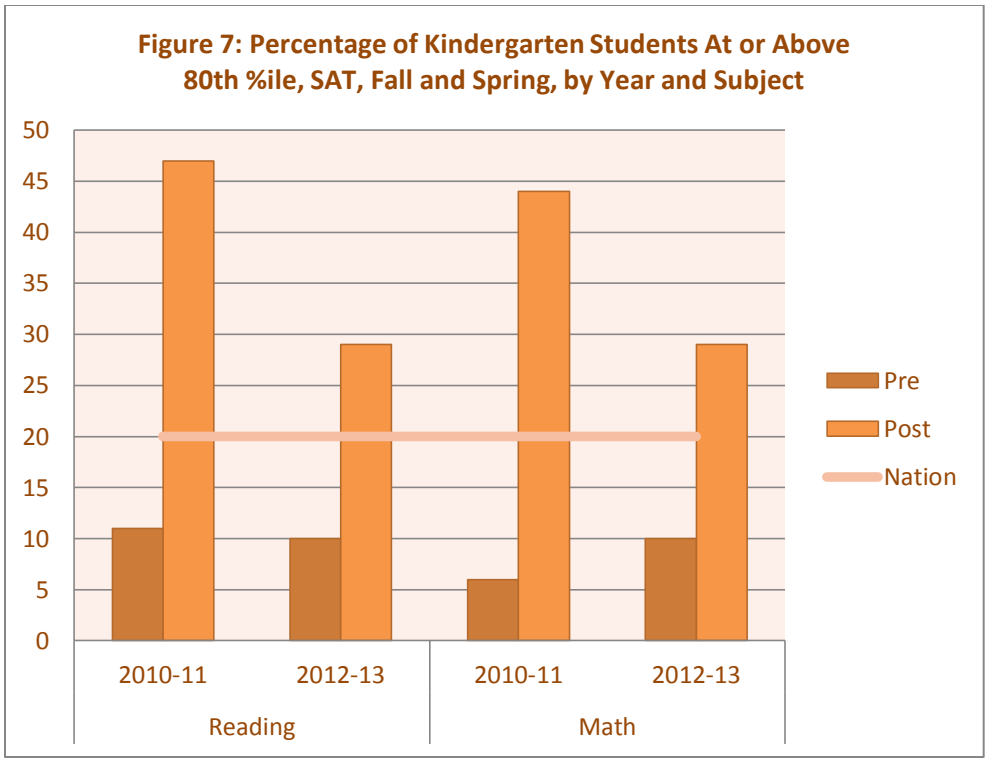


Figure 7: Percentage of Kindergarten Students At or Above 80th %ile, SAT, Fall and Spring, by Year and Subject
50
45
40
35
30
25
20
15
10
5
0
2010-11
2012-13
2010-11
2012-13
Reading
Math
Pre
Post
Nation

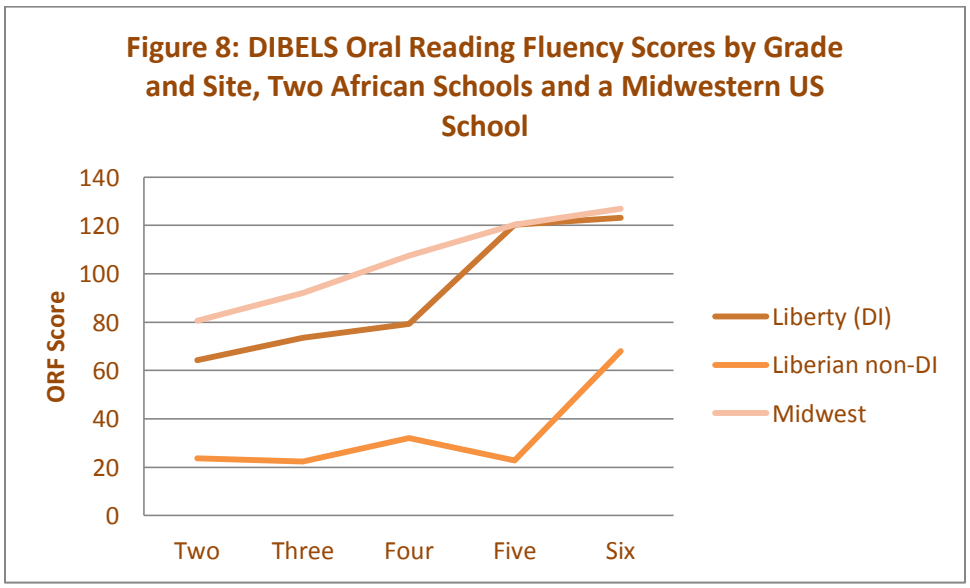
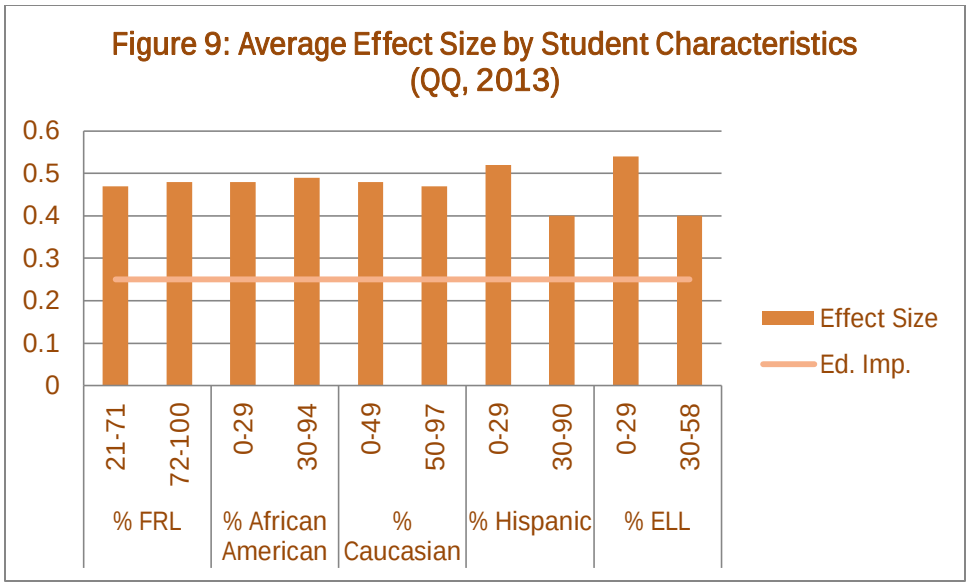
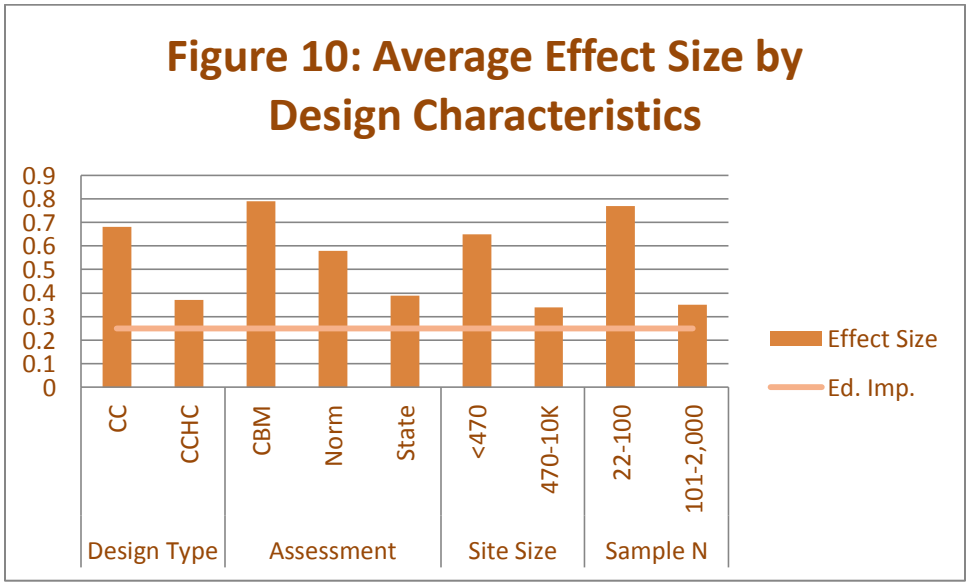


Figure 8: DIBELS Oral Reading Fluency Scores by Grade and Site, Two African Schools and a Midwestern US School
ORF Score
140
120
100
80
60
40
20
0
Two
Three
Four
Five
Six
Liberty (DI)
Liberian non-DI
Midwest



Note: The line across this Figure and Figure 10 indicate the point of "educational importance" (an effect size of .25). The bars indicate the effect size associated with studies involving different groups of students.



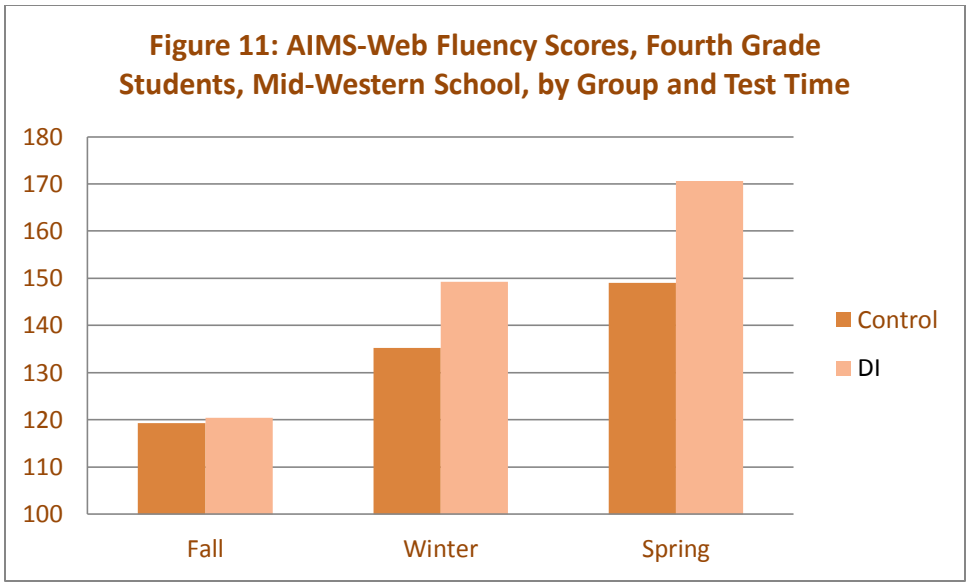


Figure 11: AIMS-Web Fluency Scores, Fourth Grade Students, Mid-Western School, by Group and Test Time
180
170
160
150
140
130
120
110
100
Fall
Winter
Spring
Control
DI

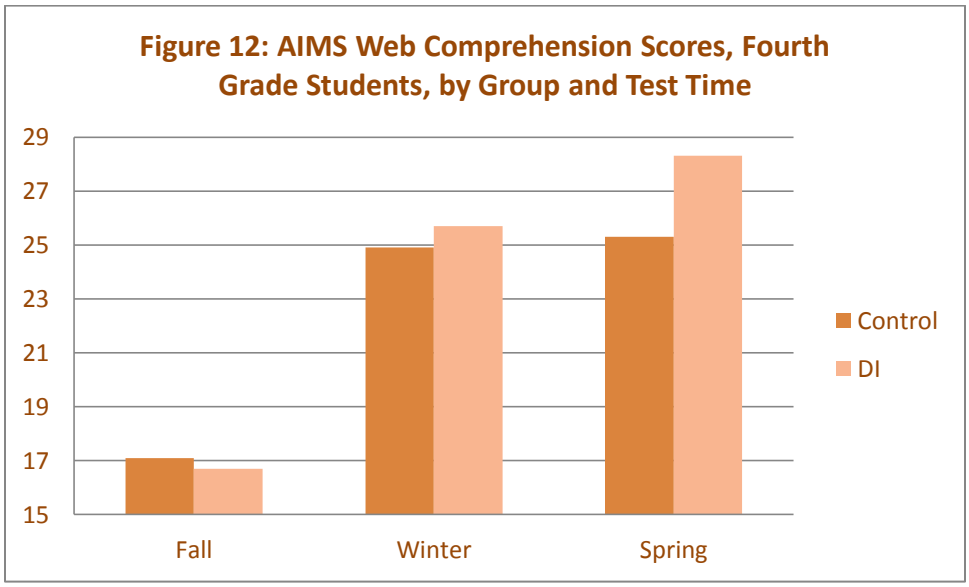
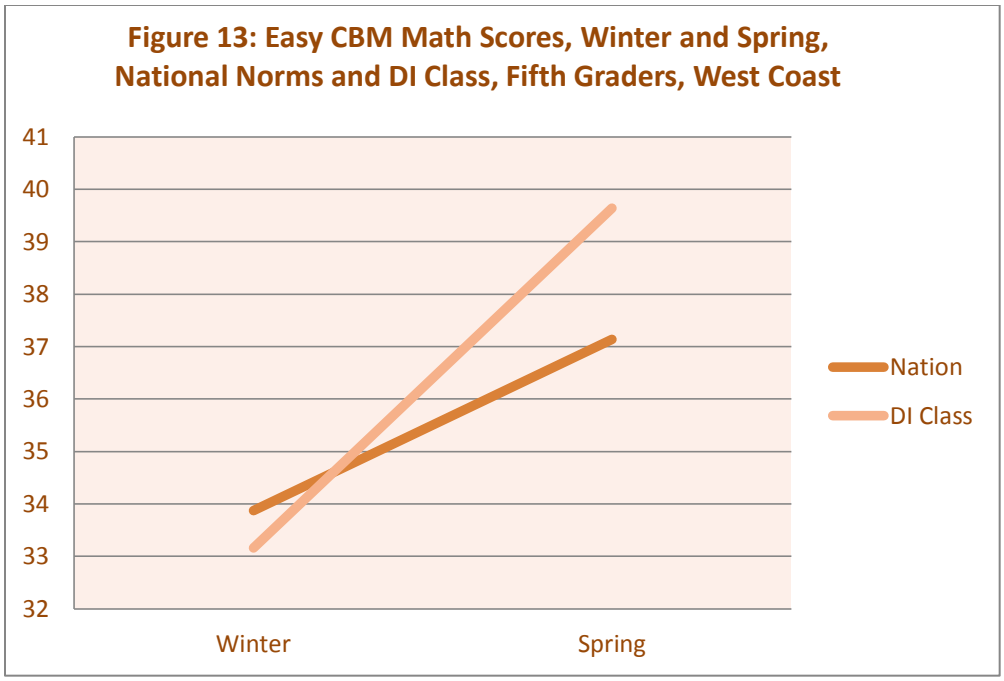
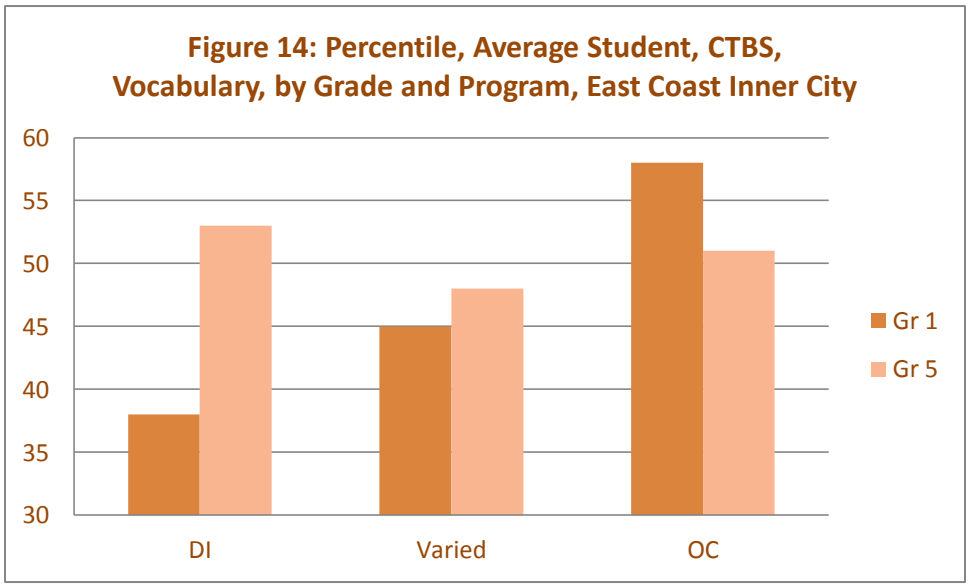


Figure 12: AIMS Web Comprehension Scores, Fourth Grade Students, by Group and Test Time
29
27
25
23
21
19
17
15
Fall
Winter
Spring
Control
DI



Note: Instruction in DI began after the winter testing.



Note: Data in Figures 14, 15, and 16 are from students who were in the same schools in grade 1 and grade 5.

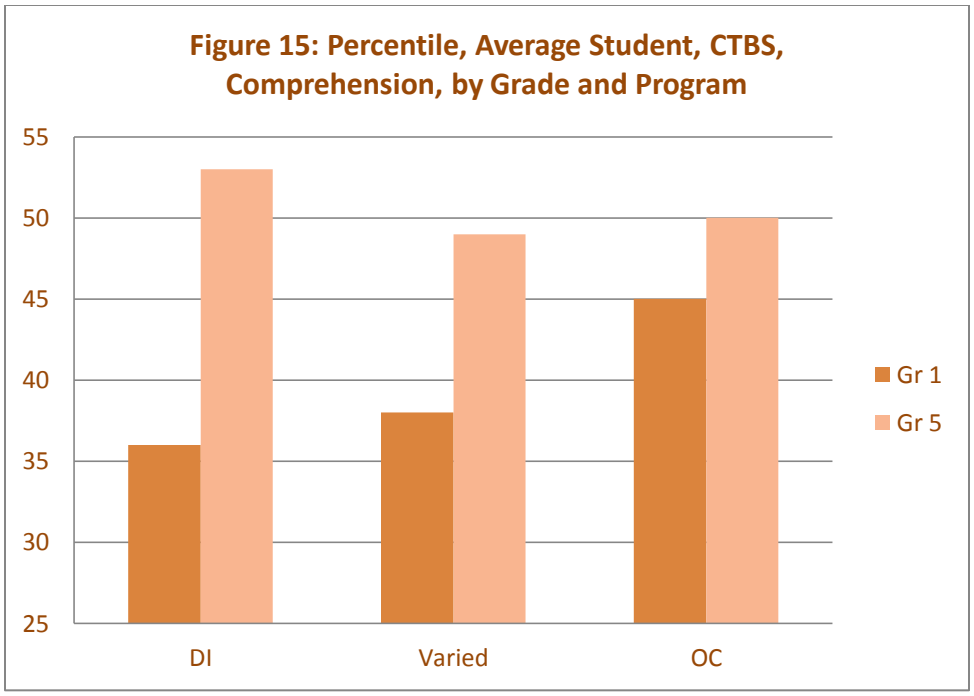


Figure 15: Percentile, Average Student, CTBS, Comprehension, by Grade and Program
55
50
45
40
35
30
25
DI
Varied
OC
Gr 1
Gr 5

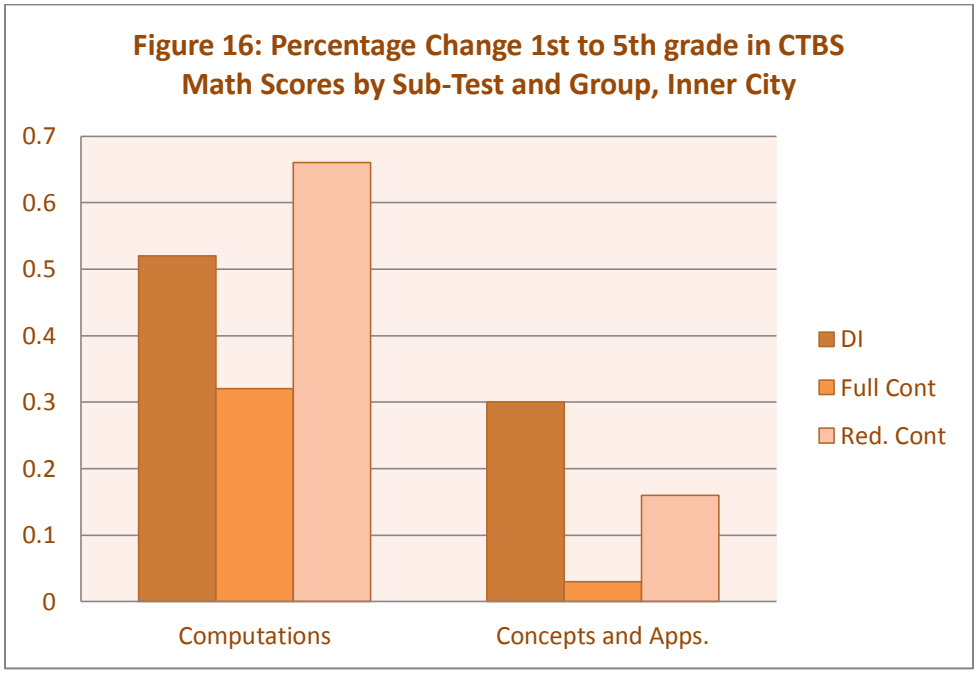
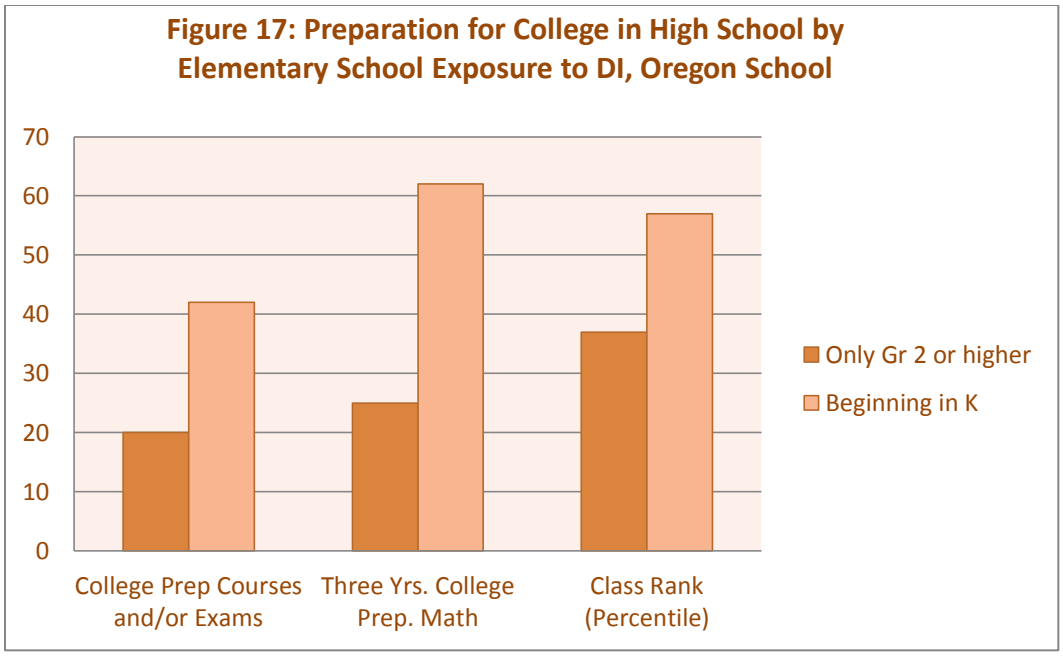
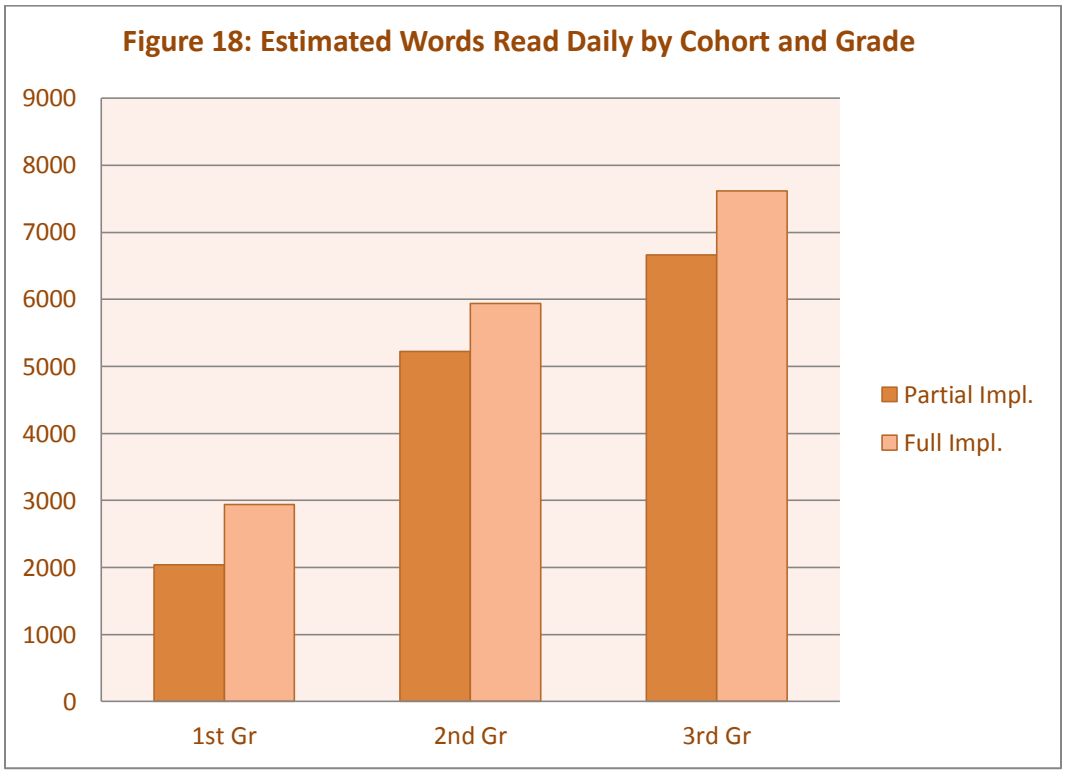
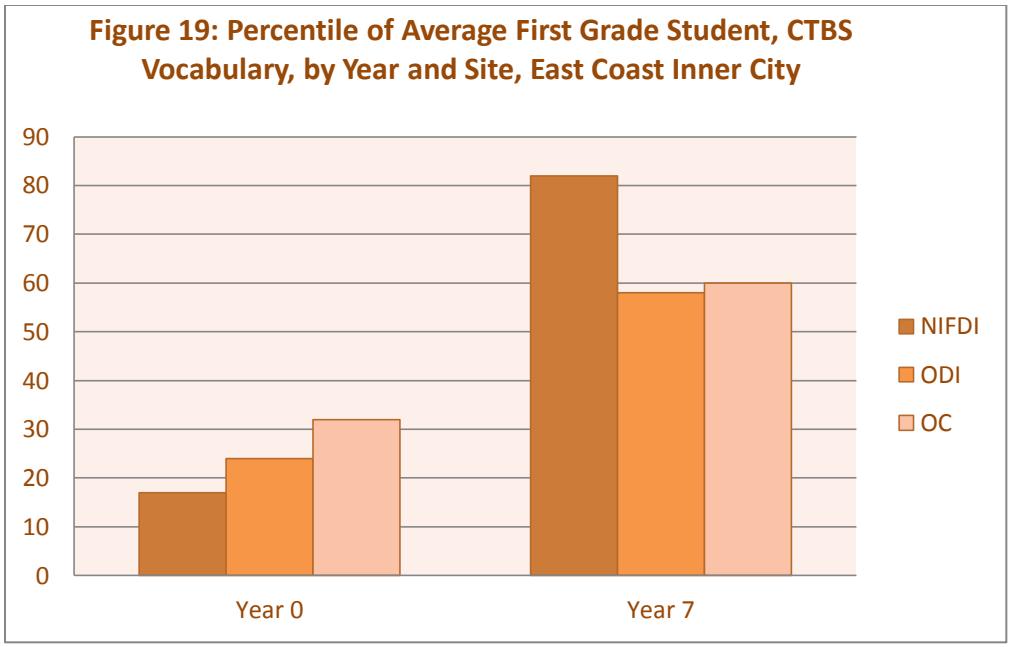


Figure 16: Percentage Change 1st to 5th grade in CTBS Math Scores by Sub-Test and Group, Inner City
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Computations
Concepts and Apps.
DI
Full Cont
Red. Cont

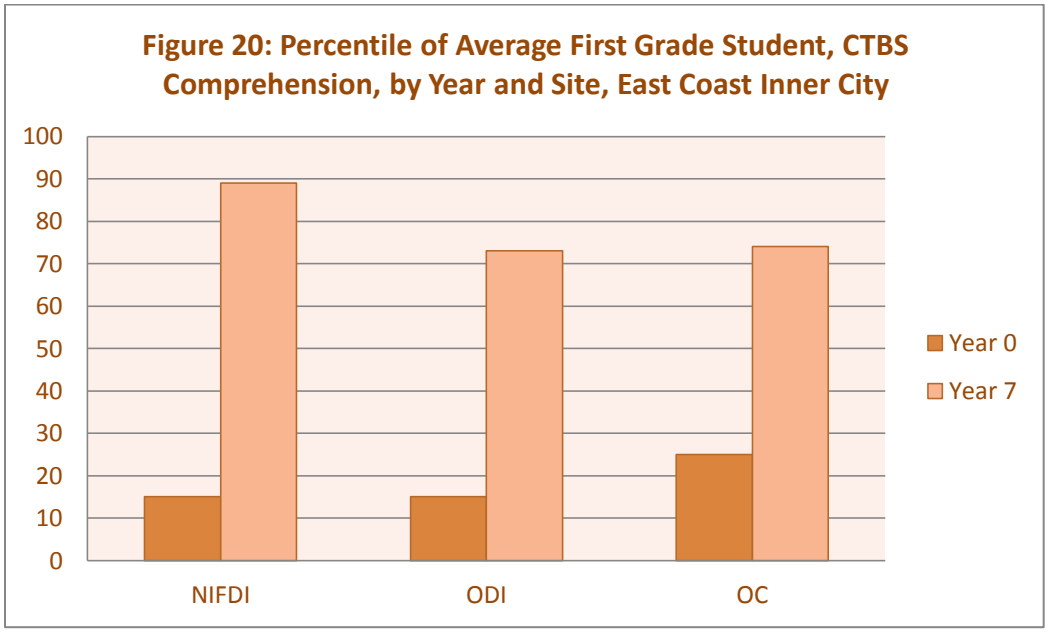


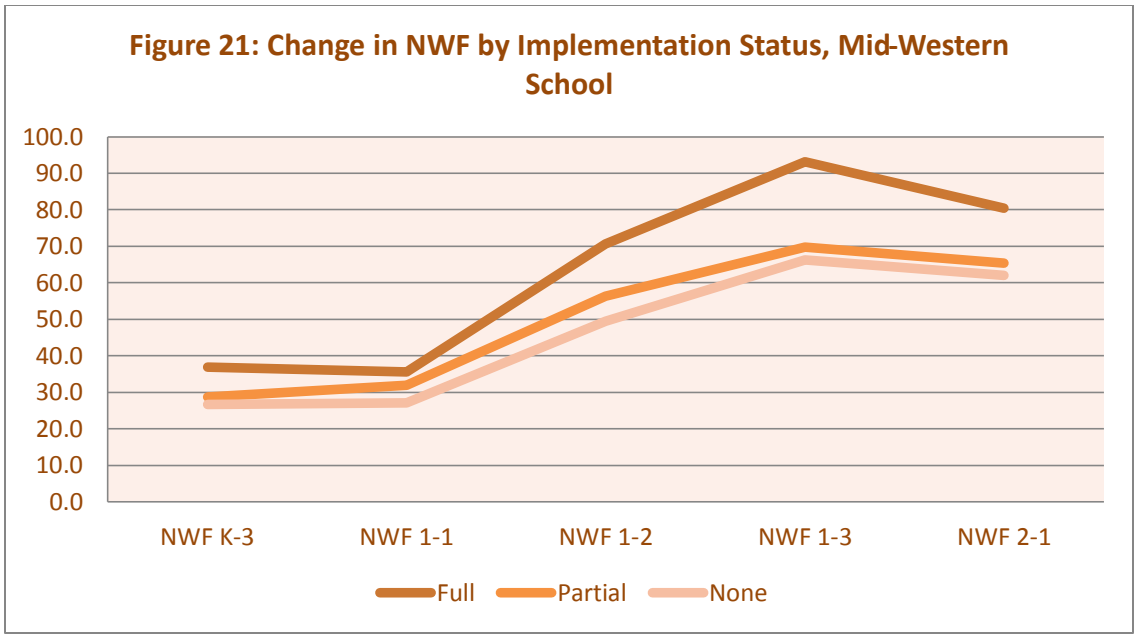


Note: Students in the "partial implementation" cohorts began work with DI in grades 2 or 3. Those in the "full implementation" group began in K.

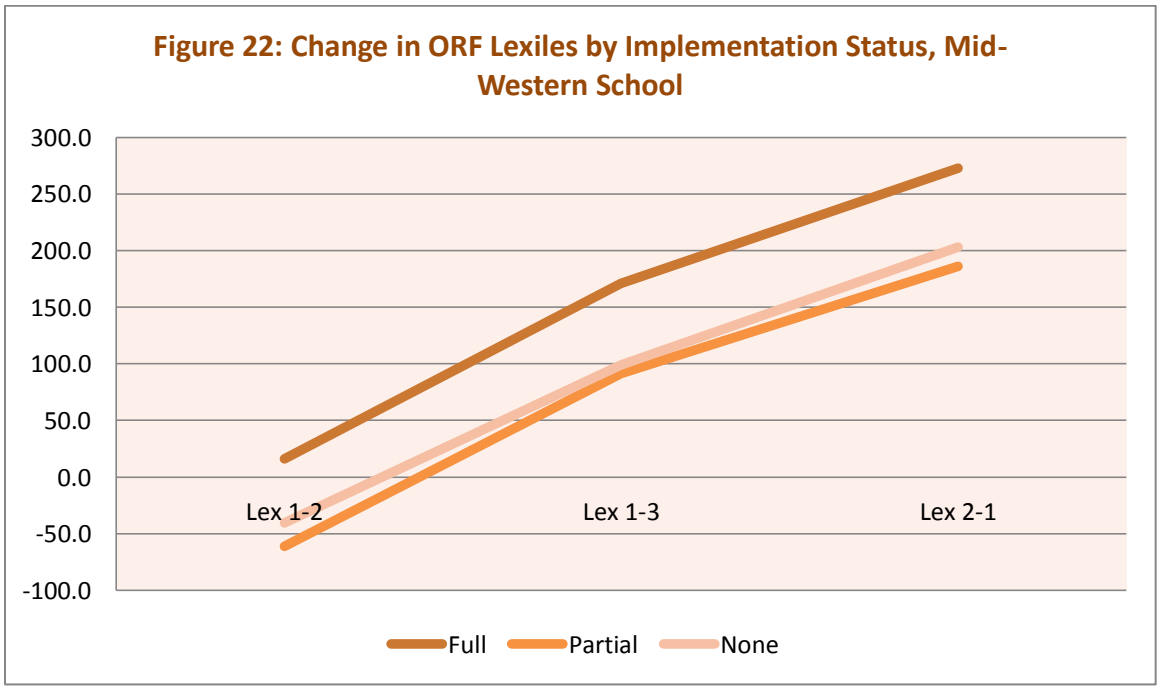


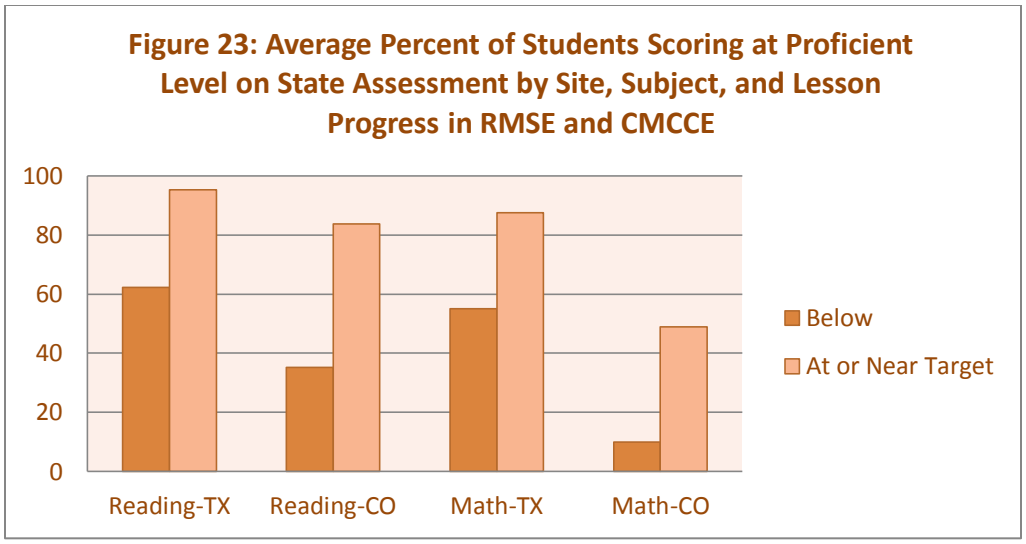
Note: For data shown in Figures 19 and 20 the NIFDI and ODI sites both implemented DI, but only the NIFDI sites tried to fully implement all elements of the model. Scores were adjusted for variations in socio-demographic characteristics and, in some instances projected over the entire time span.



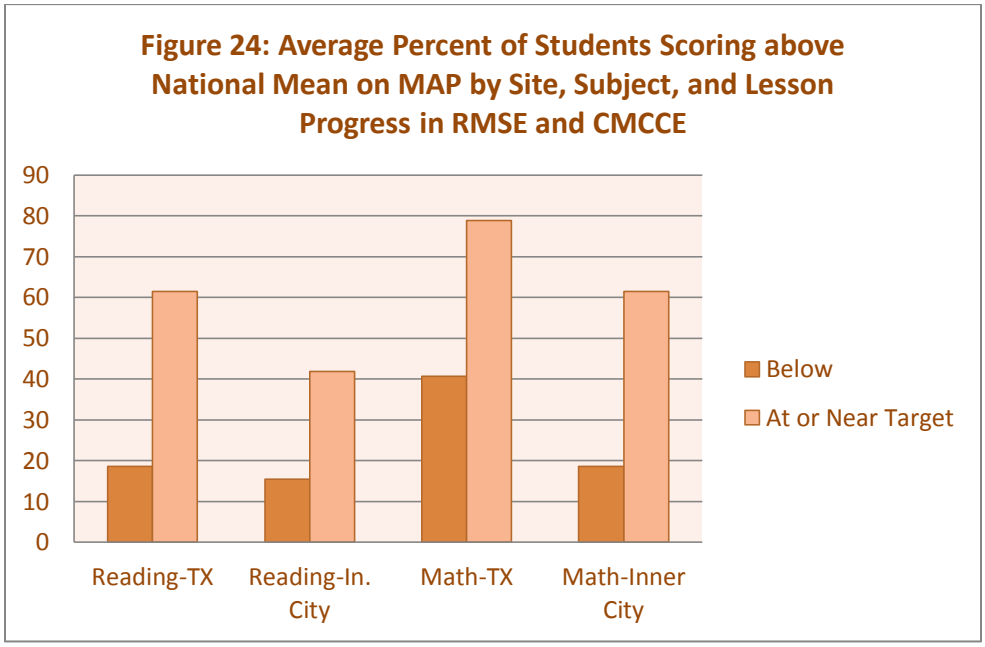


Note: In Figures 21 and 22, Full Implementation cohorts were those in the school when teachers had time to practice their presentations before teaching their classes as well as implementing other elements of the DI model. Partial implementation cohorts were those when the programs were implemented but without allowing teachers practice time. None refers to cohorts with no exposure to DI.





Note: For data in Figures 23, 24, and 25, the definition of "at or near target" varied somewhat from one site to another as, of course, did the state assessment. *RMSE* and *CMCCE* refer to *Reading Mastery Signature Edition* and *Connecting Math Concepts, Comprehensive Edition*, the most recent DI programs in reading and math.



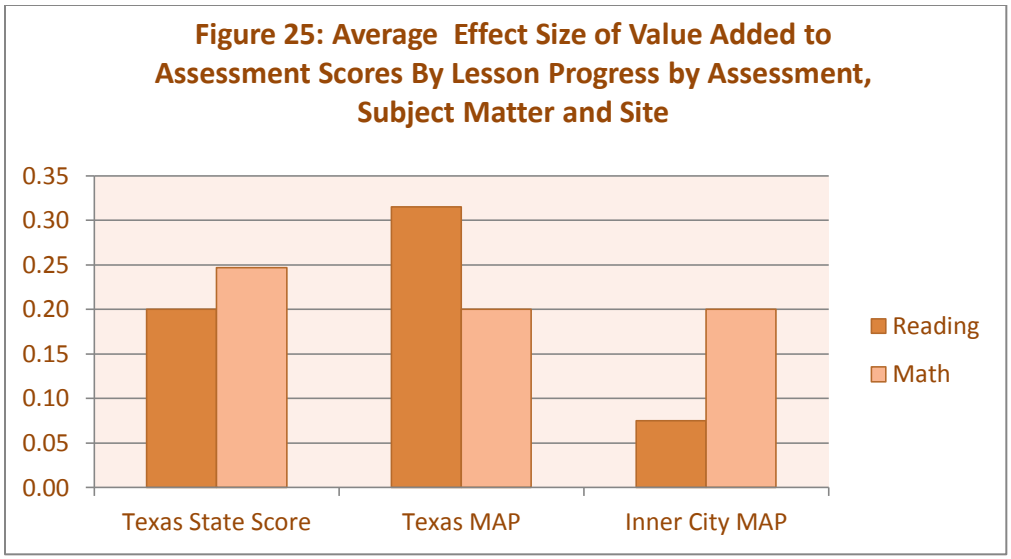


Figure 25: Average Effect Size of Value Added to Assessment Scores By Lesson Progress by Assessment, Subject Matter and Site
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
Texas State Score
Texas MAP
Inner City MAP
Reading
Math

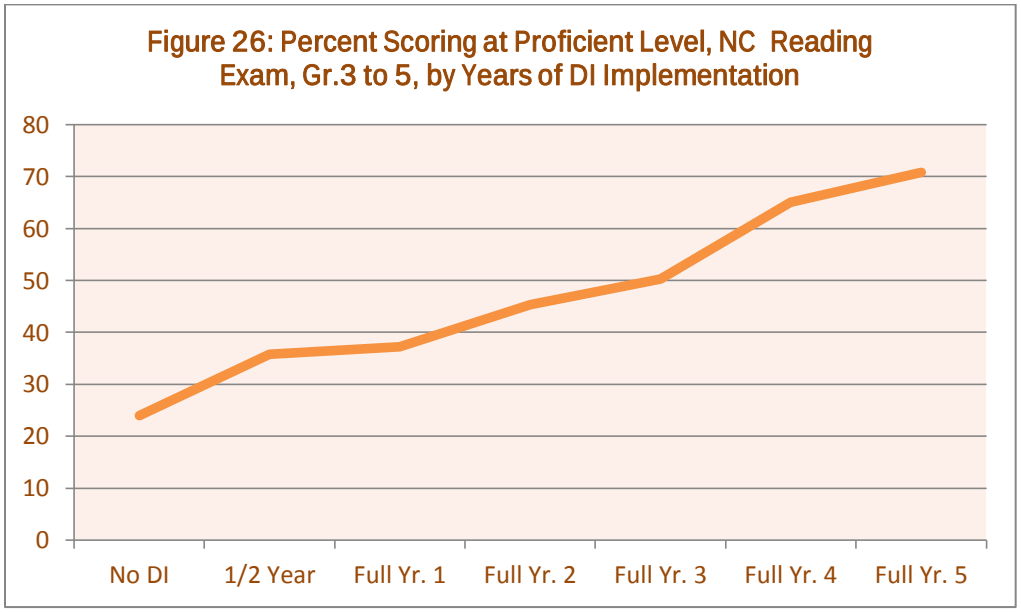


Figure 26: Percent Scoring at Proficient Level, NC Reading Exam, Gr.3 to 5, by Years of DI Implementation
80
70
60
50
40
30
20
10
0
No DI
1/2 Year
Full Yr. 1
Full Yr. 2
Full Yr. 3
Full Yr. 4
Full Yr. 5

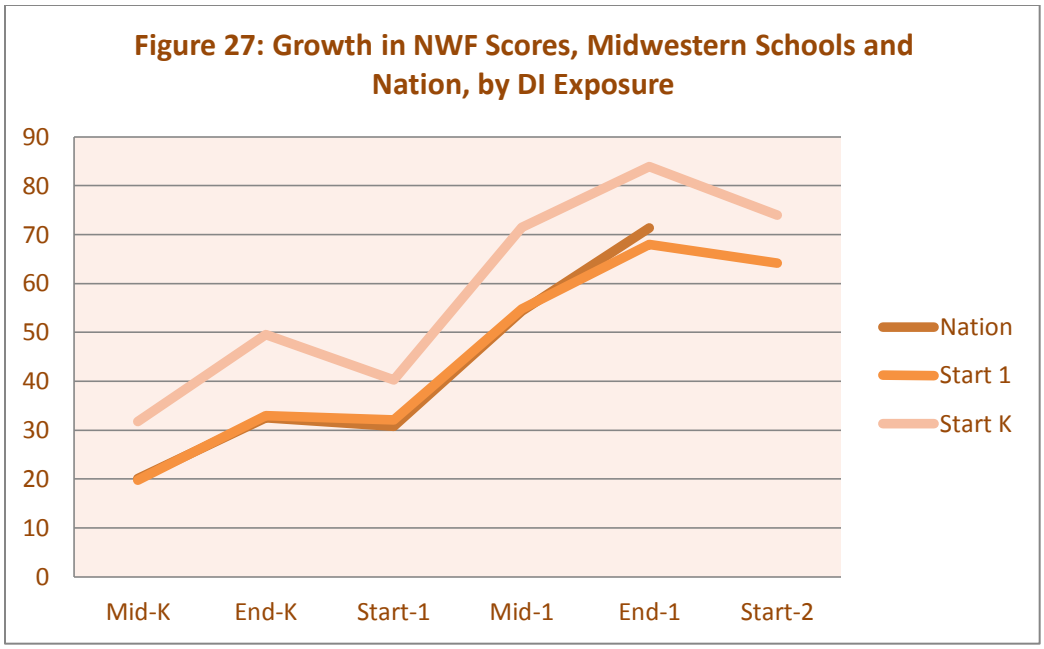


Figure 27: Growth in NWF Scores, Midwestern Schools and Nation, by DI Exposure
90
80
70
60
50
40
30
20
10
0
Mid-K
End-K
Start-1
Mid-1
End-1
Start-2
Nation
Start 1
Start K

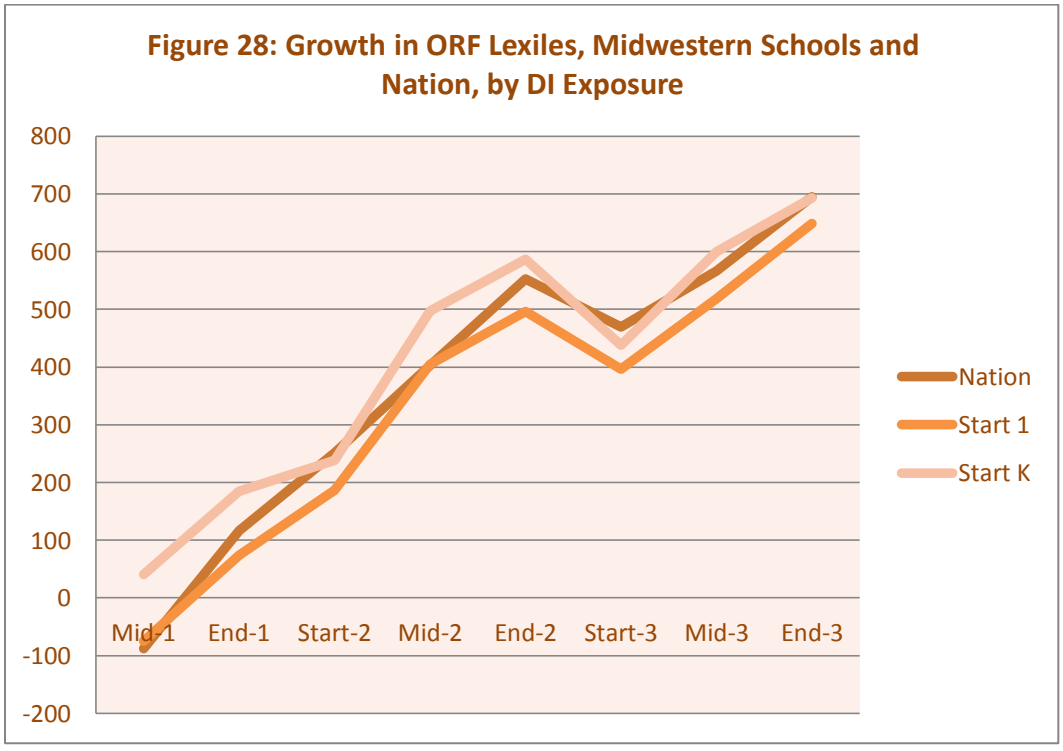
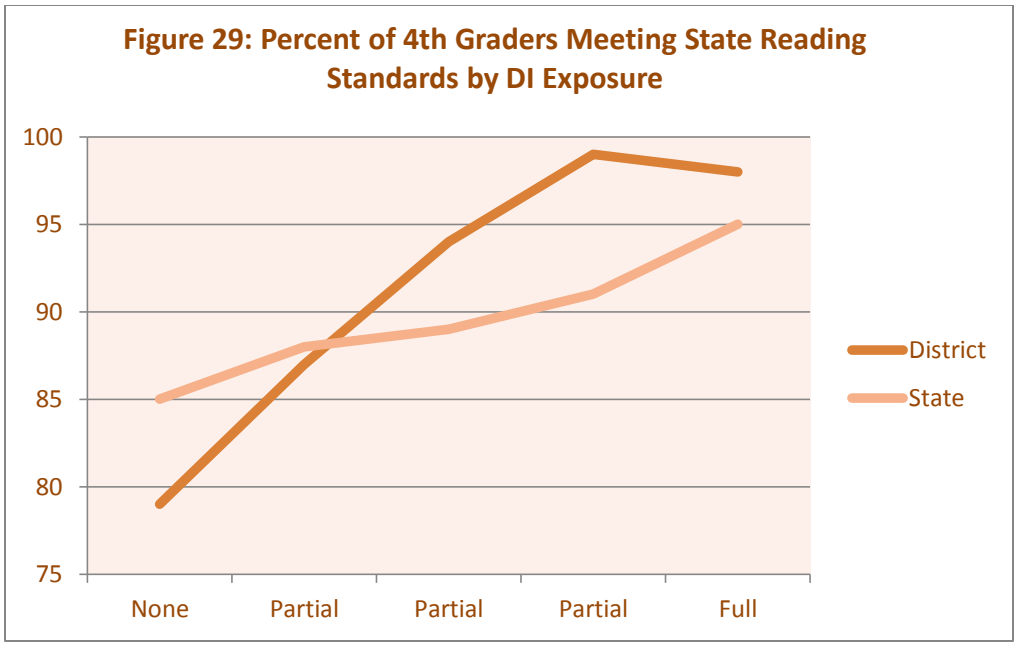


Figure 28: Growth in ORF Lexiles, Midwestern Schools and Nation, by DI Exposure
800
700
600
500
400
300
200
100
0
-100
-200
Mid-1
End-1
Start-2
Mid-2
End-2
Start-3
Mid-3
End-3
Nation
Start 1
Start K



Note: Students in the Full exposure cohort began DI in kindergarten. Those in the intervening "partial" groups began DI in later grades. The cohort whose data are displayed just to the left of the "full" cohort began DI in first grade.