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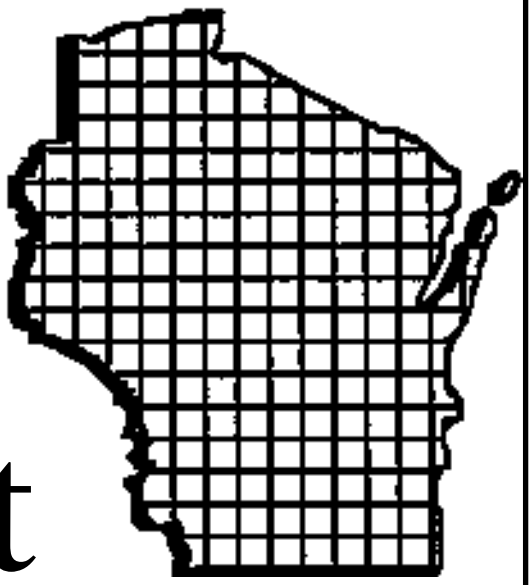


July 2005 Volume 18, Number 4

Education That Works In The Milwaukee Public Schools

The Benefits from Phonics and Direct Instruction

REPORT FROM THE PRESIDENT:

For the last generation the Milwaukee Public Schools have not found a formula for successfully educating low-income children. We have seen every conceivable idea tried to solve this problem: busing, charter schools, ongoing five-year plans, smaller school buildings, etc. Nothing seems to make a big difference. Part of this has been due to the absolute resistance of the schools of education to implementation of one type of teaching called Direct Instruction. With financial support from the Wisconsin Association of School Boards, we have analyzed this particular type of instruction.

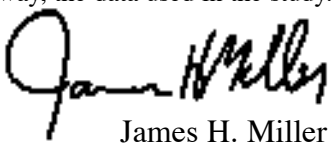
Direct Instruction is a scripted teaching method that stresses phonics for reading and traditional math instruction. We contracted with Professor Sammis White from the University of Wisconsin-Milwaukee who has been analyzing data from the Milwaukee Public Schools for over 20 years.

In this study Professor White examines not only the actual test scores for children in the Milwaukee Public Schools, but also presents recent scientific research from scholars at such institutions as Wisconsin, Stanford and MIT. This research shows that Direct Instruction, and specifically phonics, is a much better teaching technique, especially for low-income children, than the current curriculum recommended by schools of education.

With very little official support, principals and teachers using Direct Instruction are generating much better results than schools that do not use it. These results are one of the first positive indictors of a teaching technique that can actually benefit low-income children.

The research shows that students who are involved with some sort of Direct Instruction in one of 35 schools in MPS will be demographically the most difficult students to reach in the system. They are much more likely to be poor, a minority, designated special education, and very mobile during the school year, than students who are not currently being taught with Direct Instruction. This report explores Direct Instruction's impact at MPS using an examination of 23,000 students in third through fifth grade. It also raises the specter of a teaching method that actually helps poor children and yet receives absolutely no support from the educational establishment. That must change. The reason we spend over a billion dollars a year on the Milwaukee Public Schools is not to create jobs for educators, but to teach our children. We need more support for Direct Instruction, because the results we are seeing today can be dramatically improved with minimal financial support over the next several years.

Finally, besides the Wisconsin Association of School Boards, we would like to thank Deborah Lindsey of MPS for providing, in a timely way, the data used in the study.



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EDUCATION THAT WORKS IN THE MILWAUKEE PUBLIC SCHOOLS

The Benefits from Phonics and Direct Instruction

SAMMIS WHITE, PH.D.

EXECUTIVE SUMMARY

There are three basic, traditional approaches to the teaching of reading — phonics, whole word, and whole language. The latter two have been the most popular with teachers in recent years. But a good deal of research evidence indicates that phonics is the best way to learn to read.

When one examines central city reading scores, it is clear that there is a great need for improvement in reading. Students in Milwaukee Public Schools (MPS), over 80% of whom are low-income, are far below state averages on standardized tests. On the 2003-04 Wisconsin Knowledge and Concepts (WKCE) tests, for example, low-income fourth graders in MPS averaged 625 points on reading versus the state average of 647 for all students. The point difference is roughly equivalent to a year's learning for someone hoping to maintain the same level of proficiency relative to other students.

One curriculum option to close the gap between the typical MPS students and students in the rest of the state is a phonics-based, teacher-directed, explicit approach called Direct Instruction (DI). This form of instruction breaks learning into small increments, selects examples, and puts them in a logical sequence. These increments are then applied through a series of teacher-led, scripted lessons involving multiple teacher-student interactions per minute. The approach utilizes phonics for reading and similar incremental lessons for other subjects such as math. (There is also a large need for improvement in math, as the low-income, fourth-grade students in MPS averaged 614 versus 632 statewide among all students taking the WKCE in 2003-04).

DI has been ignored by many schools and districts, except for some use in special education. In recent years, however, DI has been used by over 35 elementary schools (and two high schools) in MPS. DI is the subject of this report because:

- Over 30 years of consistent research nationally shows DI has a positive impact on student achievement.
- Scientific research on how we learn to read reveals that DI, with its phonics' use, works well, especially for students at risk.
- MPS schools that use DI extensively are very complimentary of it and its impacts on their students' achievement.
- In 2003-04 some 37% of MPS fourth graders had had some exposure to DI in their years in MPS, and 21% were then enrolled in DI classrooms.
- There remains a large learning gap between low-income MPS students and others that DI appears able to reduce.

This report explores DI's recent impact in MPS, using an examination of some 23,000 MPS third- through fifth-grade students. Among the findings are the following:

- Despite students being exposed to DI being even lower income, on average, than other MPS low-income students, those individuals with long-term exposure to DI (defined as five years) do better, on average, than all low-income MPS students. In fourth grade, students with five years of DI had higher average scores, four points in reading and three points in math, than non-DI students and eight points in reading and seven points in math among relatively comparable students with one or two years of DI. These differences reflect several months of learning.
- Among low-income students tracked between third and fourth grades 2002-03 to 2003-04, those with five years of DI increased their math scores by 6.6% whereas non-low-income students increased their scores by 4.7%. This difference is statistically significant and is evidence of substantial progress.
- Among students moving from fourth to fifth grade on reading those same years, low-income students with five years of DI gained 4.2% on their test scores versus 3.9% for non-low-income. The differences are not statistically significant. But it is significant in the sense that these are very different sets of students making about the same academic progress.
- Those low-income, fourth-grade, regular education (no special education) students with five years of DI averaged 633 in reading versus 625 for all low-income students, again a substantial difference, especially when one knows the DI students are lower income and more likely to have limited English proficiency.
- Among fifth graders, those with five years of DI averaged 660 on reading (and 630 on math) compared to all low-income fifth graders who averaged 646 on reading (626 on math). The difference in reading is about

equivalent to one-half year of progress, and the 660 is again earned by a lower-income population, suggesting an even greater achievement.

- These and other higher scores and gains by those with long-term DI experience developed despite these students having more challenges to success and attending schools that usually did not have the resources to fully implement DI.
- In the few schools that did completely implement DI, defined as DI in every grade and continuous professional development for the staff, students did even better, on average. Among low-income students, with a mix of regular and special education, students scored an average of 654 on reading and 647 on math versus other low-income students who averaged 648 in reading and 622 on math. These differences suggest that full implementation leads to even greater academic gains.

The data confirm what school principals and teachers who use DI claim: DI helps to raise student achievement levels. The proof is in the numbers as well as the experience of the teachers. These gains are especially true for the more challenged population usually served by DI.

Interestingly, what DI offers, in addition to greater academic gains, is the opportunity to implement many of the elements of the District's "Capacity Builders," research-proven steps to success. These include a common curriculum, common assessments, data-driven decision making, and continuous professional development. The evidence on DI shows that all of these elements are part of successful DI implementation.

Several steps should be taken to help to ensure that MPS students have the opportunity to gain from exposure to DI. These include:

- The creation of stipends for teachers to attend the summer DI training that MPS offers.
- The generation of additional resources for more training for MPS school literacy coaches to give them additional skills as DI experts.
- The generation of additional funds for both the expansion of the number of MPS DI support staff persons (as many as three more persons could be used with the current number of schools using DI). An alternative is the use of more outside DI consultants to also regularly work with teachers to improve DI delivery.
- Creation of a local college or university Center for Direct Instruction, so that more teachers would be exposed to Direct Instruction either during their formative years or thereafter.
- Expansion of MPS Direct Instruction workshops on developing teacher DI skills and knowledge.
- Creation of seminars for principals on the merits of DI and how to best implement the approach.

INTRODUCTION

Levels of student achievement in our central city schools clearly lag those of the rest of the state. This is especially true of our largest city, Milwaukee. The two largest gaps commonly noted are those between low-income and non-low-income students and those between whites and minorities. These achievement gaps are large both within the district and in comparisons of Milwaukee with the rest of the state. In order to truly show improvement in the education of our youth, both these achievement gaps need to be addressed.

Over the years many approaches have been developed to attempt to address these gaps. Few seem to have succeeded. But there is one among them that has been demonstrated elsewhere to be successful, and it is being utilized to some degree in Milwaukee. That approach is called Direct Instruction or DI for short. This is a specific form of instruction that employs phonics to teach reading skills, and scripts and repetition to teach many skills in addition to reading. DI is used primarily for reading and math, but it also is employed in social studies, science, and writing. DI is largely used in elementary schools, but it is now being utilized in some high schools (e.g., Madison and Washington) to assist students who did not previously develop the reading skills they need to succeed in high school.

The intent of this study is to evaluate the impact of Direct Instruction in Milwaukee to see the degree to which it has helped to raise levels of student achievement in reading and math at the elementary school level. Evaluating Direct Instruction is not an easy task. The impact of any intervention in education is difficult to assess because of the many factors that affect outcomes. DI is no different. Nevertheless, it is a task worth undertaking.

As the reader will note below, there is a good deal of evidence, from studies over the last thirty years, that DI helps students achieve at higher levels. DI and the research have been controversial; that is one of the reasons for yet another study. There is, however, a reluctance and even animosity toward this form of instruction. Some teachers complain that DI is boring, or that it limits reading comprehension. Others think it is offensive because it does not allow students to be exposed to literature. Still others believe that students learn best by their own exposure to words. On the other hand, teachers who use DI say that reading ability and comprehension both increase; it is easy to use since all the lessons are already laid out; and that it is exciting to see children learn to read. The debate continues.

The animosity toward DI is especially evident in our teacher training institutions: in Wisconsin none offer instruction in Direct Instruction for regular education students. Does DI deserve such disdain, or does it merit a place among the accepted and even endorsed methods of teaching? That is what we hope to answer by yet another study of Direct Instruction.

This analysis is different from its predecessors. It does not compare schools. Rather it tracks individual students over time and compares, in aggregate, the outcomes of those with varying years of exposure to DI to those who have had no exposure to DI. What complicates the comparison is that those who are exposed to DI are more likely to be different from those who have not had DI experience. It is the low-income, inner-city schools that are more likely to elect DI because they have achievement results that are unsatisfactory. These schools are more likely to have a higher proportion of low-income children, more students identified as requiring special education, more minority children, and higher student mobility rates, to name a few differences. Thus, comparing the outcomes of students with DI to those without cannot be done without taking into account several other factors.

This study attempts to give as clear a reading as possible on the impacts of DI. A case is first made for the concept of DI. Major elements of research regarding how we learn and how well DI works are then reviewed. When it comes time for new empirical evidence, it focuses exclusively on recent MPS students. The result is a detailed assessment of the impact of DI on the achievement of a city-school population.

WHAT IS DIRECT INSTRUCTION?

Direct Instruction is an "explicit, intensive, teacher-directed instructional method" (SRA 2004). Direct Instruction has a common instructional design and presentation technique that is based on years of research on how children learn. The common elements are designed to present tasks clearly, present new material in small increments, select examples and put them in a logical sequence, provide opportunities for guided practice, and incorporate continuous assessment and management. The delivery of material involves giving placement tests and starting students at levels appropriate to their skills, following scripted lessons, using quick pacing and group responses, using planned correction procedures, and providing positive reinforcement. Teachers and students interact multiple times per

minute. Students are regularly assessed and are re-grouped several times per year to ensure they are with others learning at a similar pace. The techniques employed are based on years of research and discovery.

DI programs have many, many lessons. Thus, reading at one grade level might have 160 lessons. Unlike some programs, however, it is not a "lesson a day;" it is a lesson to mastery. That is, students move on when they are ready. Students are continuously assessed for rate of response and accuracy. Thus, a teacher may get through three lessons a week or seven; the key is mastery before the next step.

DI is used from pre-Kindergarten through ninth grade. It is used to teach reading, spelling, language arts, and math. It is also used to teach science and social science starting in the fourth grade. It has been used for regular and special education students, for low-income and high-income students, for students who are performing below grade level as well as those above grade level.

To be done well DI requires teachers to master the use of scripts, to use planned correction techniques, to provide positive feedback, and to carefully track the progress of every student every week. These tasks are not always natural. Therefore, to perfect the techniques requires a good deal of training and continuing professional development. This is a complete method of instruction that requires attention to the details of learning.

As noted above, teachers are required to do continuous assessments and to post these assessments for the principals to see. This allows not only the teacher to know where the individual students stand but it also allows the principal to know how well the teacher is doing. It is a data-driven model, just what MPS is seeking to implement more fully through the system.

Perhaps because of some of these challenges, DI is not always held in high esteem. One teacher remarked that teachers who are passionate about student success endorse DI; other teachers who are passionate about teaching method do not like DI. Those who use DI almost always endorse it highly (despite initial skepticism); those who do not use it are often adamantly opposed to it. One MPS school literacy coach said she, like many others, opposed DI when it was first adopted; then she realized that higher-level thinking was achieved because of the program. She jumped on board and has been helping to teach others ever since. She admits that not every teacher is a model teacher, but DI makes all teachers better.

In numerous interviews with principals and staffs at schools that have elected DI, compliment after compliment were heard for DI and the impact it has had on student achievement in their schools. Given such ringing endorsements, DI warrants a closer examination to see if these claims are just anecdotal evidence or reflect a larger body of evidence.

Why Might DI Work? The Science Behind Learning to Read

Reading today is basically taught using three traditional approaches. The three most traditional and prominent approaches are phonics, whole word, and whole language instruction. Some teachers meld all three, but most make a commitment to one. Odd as it may sound to a rational reader, only one — phonics — consistently appears in formal research as a method that should succeed because it makes use of the processes by which humans learn.

Phonics-based reading instruction uses individual letters and letter combinations and their corresponding phonemes, the sounds associated with the printed letters. Children are taught how to use their knowledge of the alphabet to sound out words. In whole word instruction, often called the "look-say" method, the basic units learned are "morphemes." These are the smallest units of a language to which meaning is assigned; morphemes basically consist of words, prefixes, and suffixes. The method starts with a sight vocabulary of 50 to 100 words (Rayner et al 2001). Children are taught to build knowledge of other words, based on the initial vocabulary and subsequent guessing. Whole language builds on the whole word approach but places greater emphasis on meaning. One whole-language principle is that phonics should not be taught directly; the link between letters and sounds should be learned incidentally through exposure to text (Rayner et al 2002).

One of the primary reasons there is any debate on the topic of how one learns to read is the difficulty of learning a complex language, such as English, by using alphabetic principle. The difficulty involves two sources: the abstract nature of the phonemes (especially, the sounds of consonants) and the fact that most alphabets do not code each vowel with a unique sound. In fact, in English vowels may have three different sounds. The writing system is more economic because of this, but there is greater ambiguity in pronunciation. Because of the difficulty, many educators have sought alternatives, such as whole word and whole language, as a way to make reading more fun. The

research, however, strongly suggests that it is because of these difficulties that reading is more successfully taught using alphabetic principles.

There is a good deal of evidence that shows a strong relationship between phonological awareness and learning to read (Ball & Blachman 1988; Blachman 1989; Byrne & Fielding-Barnsley 1991; Perfetti, Beck, Bell, & Hughes 1987; Trieman & Baron 1983). Wise, Ring and Olson (1999), among others, have shown that reading programs that emphasize phonological awareness training have proven successful in the classroom. These studies have shown that phonological training can teach children to read who have not learned how to read.

This message has been known for decades. In 1967 Chall concluded that the majority of research to that date tended to favor phonics instruction. Her work has since been confirmed by M.J. Adams (1990) and Foorman, Francis, Fletcher, Schatschneider, & Mehta (1998). The National Reading Panel (2000), established by the National Institute of Child Health and Human Development, wrote in the same vein:

> The meta-analysis of 38 controlled studies of phonics instruction published since 1970 indicated that systematic phonics enhances children's success in learning to read and that systematic phonics instruction is significantly more effective than instruction that teaches little or no phonics.

Despite the host of evidence that indicates that children need to learn alphabetic principles, whole language (meaning-based approaches to reading) has predominated for at least the last 20 years.

To better understand why phonics is a superior way of learning to read, a group of psychologists, linguists, and medical doctors reviewed the scientific evidence on how humans learn to read. That group included Dr. Mark Seidenberg, a psychology professor at UW-Madison. They undertook a comprehensive review of what we know about how we learn to read (Rayner et al 2001). They state that "very early, children who will turn out to be successful in learning to read use phonological connections to letters, establishing decoding as a mechanism for productive reading, the ability to read previously unencountered words." These authors reached this conclusion based in part on cognitive science and the tracking of eye movement while reading that has proven that all letters in a word need to be processed in order for the reader to access the meaning of the word quickly and accurately (Rayner et al 2001, p.47). Ehre and Wilce (1983) state that while memorizing the shapes of words may get children started reading, it is not enough for reading development to continue.

Some who argue in favor of whole language talk of the superiority of whole language in development of reading comprehension. But researchers have shown that comprehension is guided by knowledge outside the text, and that it is also partially influenced by the reader's ability to understand the words in the text (Kintsch 1988; McKoon & Ratcliff 1992; Myers & O'Brien 1998). Thus, reading comprehension is affected by the ability to decode words. Readers of high skill can compensate through decoding for lack of substantive knowledge to some extent (B.C. Adams, Bell & Perfetti 1995). The reader without skills and knowledge is very likely to fail.

The need to continue to develop reading skills is, then, fundamental to success. Success will not come, however, without practice. "Perhaps nothing is so important to successful reading comprehension as practice, by which we mean repeated engagement with reading texts of various types." (Rayner et al 2001, p. 50.) Thus, practice should be a component of all successful reading approaches.

Bruck et al (1998) compared spelling in third-grade students who had whole-language instruction throughout school with third graders who instead had phonics-based instruction. These authors found that phonics-instructed students were better spellers.

Several studies have explored what methods of teaching reading work best. Two major books and a comprehensive study on this topic have already been referenced (Chall 1967, M.J. Adams 1990, and the National Reading Panel 2000). Another contributing study is the 1998 National Research Center report entitled, *Preventing Reading Difficulties in our Children* (Snow et al). The report made no curricular recommendations. It did, however, state that research shows that beginning reading "depends critically on mapping the letter and spellings of works onto the sounds and speech units they represent."

Rayner et al (2001) not only looked at the science, they also reviewed a good deal of literature on classroom studies of reading methods. They wrote:

> Two inescapable conclusions emerge. The first is that mastering the alphabetic principle is essential to becoming proficient in the skill of reading, and the second is that instructional techniques (namely, phonics) that teach this principle directly are more effective than those that do not. This seems to be especially the case for children who are at risk of failing to learn to read [because of lack of home literacy or weak phonological-awareness skills].

The scientific evidence on how to best teach reading — phonics — is in place. What is not in place is the political will or the education sector commitment. The debate is bogged down in philosophical differences between traditional and progressive approaches.

What Evidence Is There That DI Works?

There is a good deal of research on the impact of Direct Instruction. A few studies will be highlighted to indicate the results. The US Department of Education sponsored a Stanford Research Institute analysis of 12 models of what works in education (Follow Through 1997). DI was compared with the Behavior Analysis Model, the Florida Parent Education Model, High/Scope cognitive curriculum, the Bank Street College Model, Open Education, Responsive Education, and the Tucson Early Education Model. Scores on three different tests of some 75,000 children in 180 separate sites showed that "Direct Instruction was superior both to control school and to every other model in fostering basic reading and math skills, higher-order cognitive-conceptual skills, and even self-esteem" (as quoted in Kozloff, LaNunziata, & Cowardin 1999).

Since 1997, empirical research on Direct Instruction has become even more prolific as comprehensive school reform programs that employ DI attract more interest. Because the No Child Left Behind Act of 2002 requires scientific evidence of a program's effectiveness, the quantity of research promises to grow. Both single case studies and studies comparing DI programs to other methods have shown Direct Instruction to be one of the few teaching methods used today that produces consistent results in reading scores.

For example, Carlson and Francis' (2002) examination of the Rodeo Institute for Teacher Excellence (RITE), a DI-based instruction model used in Texas, reports patterns commonly found on the effectiveness of DI. Their study followed students in kindergarten through third grade in 20 RITE schools and 20 control group schools within the district with comparable demographics and student achievement levels. The results from standardized tests administered to all of the students showed generally higher scores on standardized reading tests for students in DI, with a much higher rate of improvement between each year over the non-DI comparison schools.

Carlson and Francis also conducted an individualized treatment of progress made by students in the DI program, tracking students' length of exposure to DI. Comparison of scores from the Stanford Achievement Test (9th edition) shows two well-pronounced trends in support of DI. All groups receiving any amount of DI instruction, from one to three years, outperformed the comparison schools on both word reading and reading comprehension tests. Differences between DI and comparison students grow further when length of exposure to DI becomes a factor. Students with longer exposures to DI outperformed comparison students by a wider margin than do students with lesser amounts of DI instruction.

A second study completed in Texas by O'Brien and Ware (2002) followed the introduction of Direct Instruction into the Fort Worth school district. The district had used two different DI programs; a third group observed received instruction in one of the programs only in the second year, after it was decided to expand the program. These groups were compared to a control group within the district still being instructed under the previous whole language-based model. In general, the control schools had markedly lower minority students, much lower numbers of students on the federal lunch program, and fewer students with limited English skills.

Progress made by the Direct Instruction students during the 1998-99 and 1999-2000 school years showed dramatic improvements over students still in whole language instruction. The increase in the percentage of students passing the Texas primary reading assessment given at the beginning and the end of the study show students in the DI instruction programs to have entirely closed the gap on the whole language groups in both kindergarten and 1st grade. One-year gains made in the Stanford Achievement Test (9th edition) showed better progress in overall reading proficiency against the traditional programs in 10 of 15 cohorts.

In a much more exhaustive comparison of Direct Instruction to other school reform models, Borman et al. (2003) compared 232 separate studies examining 29 distinct comprehensive school reform models. After adjusting for the differences in measurements used in the studies, an effect statistic was computed for each reform program, reflecting the impact the program had on students' performance. From this and other factors, Direct Instruction was one of three programs that demonstrated both the highest positive effects and the highest degree of scientific proof of a program's ability.

There is also evidence that DI is not easy for some teachers to master. Berkeley (2002) found that DI can flounder because of the high degree of commitment required from staff to adhere to the well-defined, incremental steps and hierarchical knowledge structure that DI builds, the rigid and fast paced drills, and the consistent manner of feedback and behavior management. These results imply that DI should be well supported in terms of additional training to gain the best results.

Learning well and teaching well are not easy. But a good deal of evidence suggests DI does lead to greater gains in academic achievement than most alternative approaches. To see if this is the case in Milwaukee, we turn to the empirical analysis of DI in the district.

THE DETAILS OF THIS STUDY

The goal of this study is to take a rigorous look at the DI program in MPS and to develop a clear understanding of just how successful it has been in raising levels of student achievement. As has been noted, an increasing number of MPS schools are using DI, but there is still a good deal of resistance to its use. If there is well-supported evidence that DI does or does not add value in this setting, such knowledge may help steer future decisions on DI utilization and support.

The basic study design involves tracking over 23,000 MPS third-, fourth-, and fifth-grade students between the fall of 1998 for the oldest — or whenever they entered the system for others — and spring 2004. The basic measures of outcomes are math and reading test scores on Terra Nova exams for third and fifth grades and the Wisconsin Knowledge and Concepts (WKCE) tests for fourth grade. Students with exposure to Direct Instruction are compared to students without any exposure to Direct Instruction.

Determination of which students were exposed to DI was based on an exercise that identified all MPS elementary schools that had elected DI, what years they used DI, and in which grades they used DI in the years they offered Direct Instruction. This exercise was undertaken by the MPS DI Specialist and the DI sales representative who has a record of what materials were sold to what schools at what dates. Thus, if a student was identified as attending a particular school that used DI in that grade and year, that student was said to have had one year of DI instruction.

Unfortunately, there is considerable student mobility within MPS. Some students may not have had full years of DI. We identified attendance at schools by the identification of the schools associated with given test scores. There is not a record available of the multiple schools a student attends in a given year. This may have a slight effect on the findings, but it is not likely to have a great impact since some students in non-DI programs also were mobile.

The data examined are for students in MPS who were enrolled in MPS for the full year, defined at between 170 and 180 days. This is not attendance but the number of days in which they were formally enrolled in MPS. They may well have attended fewer days. The count of students is based on the enrollments in 2003-04. Subsequent analyses of test scores and student characteristics are focused on students who were enrolled in MPS 170-180 days in the school years of 2001-02, 2002-03, and 2003-04. This constraint was applied to create a more comparable pool of students to analyze.

The main measure of student achievement utilized is the mean scale score on the standardized tests. In a couple of instances, we also examine the distribution of scores. But the scale scores that adjust the number of correct responses to test items to help describe growth that occurs as a student progresses through the grades are thought to be the best measure with which to compare student performance. There is no single range of scores for all possible tests. But for the grades analyzed, the means generally varied between 590 and 680. The full range of scores for the fourth grade WKCE went from 433 to 780 in reading and 403 to 770 in math.

One note to the reader is that the few point distinction between students on several comparisons of test scores noted below may seem immaterial, but they are not. One year's progress in school varies among grades and among income and ethnic groups. In some cases a year's progress in elementary school is a gain of 10 percentage points on a scale score. In other instances the difference may be 15 or 20 points.[1] Thus, a gain of five points may be between one-quarter and one-half a year's learning. That ground is not easy to make up.

1. In 2002-03 the mean reading score in Wisconsin was 646.0 and the reading math was 631.6 for fourth-grade students. For eighth-grade students the respective scores were 686.9 and 704.9. Thus, the differences were 40 points in reading and 73.3 points in math. If we assume common annual progress, each year of school raised the average score by 10 points in reading and 18.3 points in math. These are just one sample. But they do give some indication of what annual progress might be. These translate into 0.8% to 2.9% gain per year. References in the text to gains of five points or even 3% may appear to be modest, but they often are not.

THE CHALLENGE IN MPS

Student achievement in Milwaukee Public Schools (MPS) is far below the state norms, be the measure standardized test scores, graduation rates, or Advanced Placement test scores. On fourth-grade math and reading, for example, MPS students do not do nearly as well as the state-wide averages in terms of the percentage of students with advanced or proficient knowledge. Below in Table 1 are listed the results of the WKCE test results from November 2003, the latest data that were available.

TABLE 1 WKCE DISTRIBUTIONS FOR MATH AND READING, FOURTH GRADE, MILWAUKEE AND WISCONSIN, 2003-04

	Math		Reading	
Result Categories	**MPS (%)**	**WI (%)**	**MPS (%)**	**WI (%)**
Advanced:	15	29	25	43
Proficient:	41	45	46	39
Basic	15	10	20	12
Minimal	28	14	9	4

Source: 2003-04 WKCE scores for fourth grade; Department of Public Instruction for WI; MPS special run for MPS.

Almost twice the proportion of students statewide, as opposed to those in MPS, scored in the advanced category in math. In reading the gap is not as large: just over 70% more students statewide score in the advanced category in reading. MPS makes up some of the ground with a higher proportion in Proficient on the reading exam, but MPS is further behind on math. MPS has almost twice the percentage of students in the bottom two categories for both reading and math.

The achievement gap is wide. It should be closed. Low-income and low-income minority children are two groups commonly associated with lower levels of student achievement. They are the common explanations for the lower levels of achievement in Milwaukee. The next data illustrate the degree to which low-income children and minority children do worse on achievement tests in Milwaukee.

Before examining the data it is important to note the impact of income cannot be easily assessed because the true income of school families is not available. Instead, we must use a surrogate, the eligibility of the families for free or reduced-price lunch. This is based on income by family size. Students are eligible for free or reduced-priced lunches if their family income, adjusted for family size, is less than 175% of the federal poverty line. Thus, there are families who may be above poverty mixed with those who are well below poverty. We would expect different levels of student achievement based on these differences. But we cannot pinpoint them, given the deficiency of the data. That said, it is the condition with which almost all education studies must contend.

Do low-income children, those eligible for either a free or reduced-price lunch, achieve at lower levels, on average, than those with higher incomes? The answer in Milwaukee (and elsewhere) is yes, on average. The accompanying chart reveals the mean scale scores on math and reading of all students who took the standardized tests in 2003-04 by the grade in school for grades 3 through 5 in MPS. There is a consistent pattern: those eligible for lunch did not score as well, on average, as those whose family incomes were too high to qualify for a subsidy. The point differential ranged from 16 to 24 percentage points or 2.6% to 3.8% higher in terms of mean scale scores.

What the scale score differences mean in terms of gap to be closed varies by grade and by subject: there is no concrete expectation regarding how many scale score points a student "should" increase each year. For example, the 21 point difference in scores in the third grade math is such that both averages are in the "proficient" range. The 585, low-income score, is near the bottom of the range, and the 606 is in the middle. To maintain the "proficiency" designation in fourth grade, the low-income students would have to raise their scores by about 20 points over the 12 months between the third and fourth grade testing. On reading, the low-income students would have to raise their scores by about the same 20 points to remain the same relative to others. Thus, one can say that about a 3% gain among third- to fourth-grade students is equivalent to a year's progress, if the student is to remain in about the same place relative to other students.

For low-income fourth graders on reading, their average of 625 is toward the low-end of the "proficiency" range. They need raise it only ten points to remain "proficient" at fifth grade. But to be in the same relative position, they

need to raise their scores to 644 or by 19 points. Thus, one can say a full year's progress can be term equivalent to a 19 point gain, on average. Someone who gains ten points can be said to have made about a half-year's gain, relative to others. None of these changes are cast in stone; they just help to put in perspective what may appear to the reader to be small gains.

TABLE 2 MEAN STANDARDIZED TEST SCORES BY GRADE AND SUBJECT, BY ELIGIBILITY FOR SUBSIDIZED LUNCH, 2003-04

	Math		Reading	
Grade	Lunch	No lunch	Lunch	No Lunch
Third	585	606	608	631
Fourth	614	630	625	647
Fifth	626	646	646	670

Source: MPS Special Data Run

The learning gap by income is one that must be addressed. It is often discussed, and numerous initiatives have been launched to reduce the educational outcomes across income groups.

The second common element of an education gap that appears related to the income gap is that of ethnicity. Do ethnic groups score differently without regard to income and then with regard to income? As the reader would expect, there are wide differences across ethnic lines. Some of these may have to do with English not being the first language. Other differences may well relate to income or combinations of income and language challenges or several other factors on which we have limited data.

In Table 3, we look at the differences across the four major ethnic groups in Milwaukee, categorized the way the school district differentiates among racial/ethnic groups. Regardless of grade, there are marked differences among the four categories. White students, who are much less likely to qualify for free or reduced-price lunch, do better by a sizable margin (often as many as 30 points) on both reading and math than African American students. White student averages exceed Hispanic student, but not by as wide a margin. White students also do better than Asian by numerous points on reading but by a reduced margin on math. And Hispanic students, who do not do as well, on average, as whites and Asians, score several points higher than African American students.

What is good to note, however, is that averages increase within each race each year. Thus, fourth grade reading scores among Blacks are 3% higher than third grade and fifth grade is 3.2% higher than fourth grade. Among whites the differences are 2.7% and 3.1%, respectively. Those percentages should help to show that changes on this scale reflect a difference, on average, of between one-half to one school year. That is about the size of gain required to remain in the same relative place in the "proficient" reading category at fifth grade. If the goal is to create even better readers, that is "advanced proficiency," Blacks would have to make a minimum 7.5% gain and whites, a 3.4% gain, on average.

TABLE 3 MEAN SCALE SCORES, MATH AND READING BY ETHNICITY AND GRADE, 2003-04

	Math				Reading			
Grade	Asian	Black	Hispanic	White	Asian	Black	Hispanic	White
Third	604	580	594	610	615	607	613	633
Fourth	629	611	618	634	634	625	625	650
Fifth	642	622	633	653	652	645	650	670

Source: MPS Special Data Run

Table 3 reveals there is no question but that there are sizable differentials in test results across ethnic groups. This is another challenge facing educators. Because we know certain ethnic groups have lower average incomes, we need to look at the distribution of scores by race and income to see the degree to which the differences in scores can be more strongly associated with income rather than ethnicity or other variables.

One way to examine this is to compare average test scores by ethnicity within the low-income population. Table 4 reveals the average scale scores by grade and ethnic group in 2003-04 among low-income students.

TABLE 4 MEAN SCALE SCORES, MATH AND READING, AMONG LOW-INCOME STUDENTS BY ETHNICITY AND GRADE, 2003-04

	Math				Reading			
Grade	Asian	Black	Hispanic	White	Asian	Black	Hispanic	White
Third	601	578	593	599	610	604	611	624
Fourth	627	610	616	625	631	623	623	641
Fifth	640	621	631	642	650	643	647	657

Source: MPS Special Data Run

On math scores, Asians actually led whites in third and fourth grades among low-income students. But the gap is narrow. In fifth grade whites led Asians by two points, on average. Both of these groups did better than Hispanics who, in turn did considerably better than Blacks. On reading scores, whites led in all grades, followed by Asians (usually), Hispanics, and Blacks. The differences between whites and others in reading are not quite as dramatic as those in math. But the differences in reading scores are still substantial, being as high as 20 points in third grade and 18 points in fourth. These points translate into almost one year of academic progress.

The differences that are more substantial are the score differences between the low-income and the non-low-income whites on math and the differences among all ethnic groups in reading (Table 5). On fifth-grade reading, for example, the differences are 12 points for Asians, 17 points for Blacks, 21 points for Hispanics and 23 points for whites. In fourth grade, reading differences between low- and non-low-income are 13 to 16 points. Math differences are smaller in both grades, but they are still substantial. Income does matter.

TABLE 5 COMPARISONS OF AVERAGE SCALE SCORES FOR MATH AND READING BY ETHNICITY AND INCOME GROUP, FOURTH AND FIFTH GRADE, 2003-04

	Math				Reading			
	Asian	Black	Hispanic	White	Asian	Black	Hispanic	White
Fourth Grade								
Low Income	627	610	616	625	631	623	623	641
Non-Low- Incomes	636	617	628	639	644	637	639	656
Fifth Grade								
Low Income	640	621	631	642	650	643	647	657
Non-Low-Incomes	650	631	643	660	662	660	668	680

Source: MPS Special Data Run

Given that low-income, especially low-income, minority students do not do very well, it is reasonable to ask whether there are steps as seemingly simple as curriculum adoption that can help these students achieve at higher levels. Specifically, does Direct Instruction help these students achieve at higher levels? That is where we turn next.

THE IMPACT OF DIRECT INSTRUCTION

Direct Instruction was used in several schools (35) in MPS in 2003-04. The number of schools using DI grew over the 2000-04 period. Not all schools implemented DI in all grades. Several restricted DI to kindergarten and first grade or kindergarten, first and second grades or even kindergarten through third or fourth. Some schools worked very diligently to put DI in place, following up with repeated teacher training. The majority of schools did not have the resources or the commitment to do this. But the majority did try to be consistent in their application. The variations in the level of DI implementation will be examined later.

At this point, the issue is what proportion of children in grades three to five in MPS in 2003-04 were using DI curriculum, and how did the 2003-04 test scores compare based on the number of years of DI exposure the students had experienced. (Students were listed as having had DI in a given year if they attended a school with DI in the grade they attended that year. Thus, some students were in DI schools in all years they attended; others had a year or two, as they moved between schools, or they attended a school with a limited DI program.)

In the 2003-04 academic year, some 23% of third and fifth graders and 21% of fourth graders were in DI classes. Thus, DI reached over one-fifth (22%) of the students in MPS in these three grades. Many more students had been exposed to DI sometime in their school history (for example, in 2003-04, 37% of MPS fourth graders had had at least one year of DI sometime). But just over one-in-five was involved in DI in 2003-04.

Impact of DI

The first analysis of the impact of exposure to Direct Instruction is by grade in school. We examine the results for fourth- and fifth-grade children. (Third-grade students have been excluded because of space limitations, largely similar outcomes, and less data being available since Terra Nova reading tests are optional in third grade.) We initially compare the children, without regard to income, race, or other characteristics that may influence the outcomes. Generally, we can say we expect DI students to not do as well as those without exposure to DI, since DI is much more likely to have been used with low-income children, children who generally do not do as well as those with higher incomes (as illustrated above).

There are some differences between those who have been exposed to DI and those who have not. The most pronounced difference is the percentage of students enrolled in the free and reduced price lunch program (Table 6). Some 91% of those fourth graders in DI in 2003-04 were enrolled compared to 74% of students who were not in DI programs of study. Another difference is the percentage of white students: DI schools had but 7% whereas other schools had 19%. Also quite different was the proportion of those with Limited English Proficiency: DI had twice the proportion (20% v. 10%). Thus, on several counts DI students tend to be different from those who attend other than DI schools. Those differences likely play some role in explaining the differences in outcomes between those at DI and other schools.

TABLE 6 SELECTED CHARACTERISTICS OF MPS FOURTH GRADE STUDENTS EXPOSED TO DI COMPARED TO THOSE NOT EXPOSED TO DI, 2003-04

Characteristics	DI Students	Non-DI Students
Percent White	7	19
Percent Special Education	15	17
Percent Limited English	20	10
Percent Low Income	91	74
Percent in same school 3 yrs	70	77
Percent of Students	20.6	79.4

Source: MPS Special Data Run

Years of Direct Instruction

The first question is whether those with more exposure to DI, defined as years of DI, do better than those with less exposure. At the fourth grade in 2003-04, those with no DI had mean scale scores on math and reading of 620 and 633. Those with long-term exposure (five years) did almost as well as those with no exposure to DI. Math and reading scale scores were almost identical: 620/619 for math and 633/632 for reading. That appears to indicate that among all students those with five years of DI instruction did about as well as those without any DI exposure.

What is not as clear is the role of fewer years of DI. There is little difference in average scores between one to two and three to four years of DI. When we look to see if enrollment in DI during the test year makes a difference, the answer is yes, a modest difference. Students with one to two years of DI added two points on reading; those with three to four years of DI added one point, if they were in DI at the time of testing. That is all that might be expected, given that the students had had only two additional months of DI (September and October with the tests on November 3rd), not an additional year. These students still did not do close to as well as students without DI. We shall see below that students with limited exposure to DI are different from the other students.

TABLE 7 MEAN MATH AND READING SCALE SCORES FOR FOURTH AND FIFTH GRADE STUDENTS WITH VARYING YEARS OF DI EXPERIENCE, 2003-04

	Average Scale Scores							
	0 Years DI		1-2 Years DI		3-4 Years DI		5 Years DI	
Grade	Math	Reading	Math	Reading	Math	Reading	Math	Reading
Fourth	620	633	611	625	611	623	619	632
N =	2960	2960	795	795	653	653	291	291
Fifth	633	653	623	644	626	647	630	653
N =	2926	2926	985	985	399	399	252	252

Source: MPS Special Data Run

At the fifth grade those with five years of DI read, on average, as well as those with no DI, scoring a 653. In math those with five years of DI were three points lower (630) than those with no DI (633). Again, those with between one and four years of DI did not score as well as those with either no DI or five years of DI. Continuous DI does seem to make a positive difference, especially in reading, for those students who we know are more commonly poor. This has been shown in previous research (Carlson and Francis 2002).

Impact of Income

It is obvious from these several findings that we need to look more specifically at factors, such as income, that potentially influence achievement. The one data element we can use to discuss income is eligibility for free or reduced-price lunch. We have separated the students into two groups, those eligible for free or reduced-price lunch and those who are not. As we have discussed, this is not a perfect measure, but it is what we have to work with. To further speed the analysis, we will examine the differences in average scale scores for those with varying years of exposure to DI by eligibility for free or reduced-price lunch.

TABLE 8 AVERAGE WKCE SCORES FOR MATH AND READING BY INCOME AND YEARS OF DI, FOURTH GRADE, 2003-04.

	Math		Reading	
Years of DI	Lunch	No Lunch	Lunch	No Lunch
0 yrs	616	631	626	648
1-2 yrs	609	624	623	643
3-4 yrs	610	622	622	640
5 yrs	617	639	629	659

Source: MPS Special Data Run

Among fourth graders, it is clear that, on average, those with higher incomes do better than those with lower incomes. Looking across the rows, those with no lunch subsidy did better than those with lunch subsidy, regardless of the exposure to DI. For those with no DI (the top row), the differences were 15 scale points on math and 22 scale points on reading. This is equivalent to non-subsidized students scoring, on average, 2.4% higher on math and 3.5% higher on reading. Again, these differences are approximately equivalent to one year's progress. Those with five years of DI do markedly better than those with some DI. And those with five years of DI did better than those with no DI, especially among those with no lunch subsidy. In other words, DI works very well for those with higher incomes. DI also seems to help those with low incomes.

What is interesting is that with exposure to DI, the gaps get larger; that is, those with higher incomes and exposure to DI seem to make greater gains (reading scores are 11 points higher — 659 v. 648 — among those with 5 years of DI compared to those with none). But the small number of non-subsidized students with five years of DI in the universe (31) suggests that we should use these scores with great caution.

What is more important to note is that among low-income students, those with five years of DI did better, on average, than those with no DI. DI students did three points better on reading and one point better on math. This is

an indication that among all low-income students multiple years of Direct Instruction help students achieve at higher levels in both subjects, but especially in reading. That is from a program that is not well supported in many of the schools that use the curriculum. It is from a program that is not at all supported by the schools of education.

Among the poor, what may seem a bit confusing is that those with a few years of DI do worse than any other groups. It is possible that the scores of those with less DI may be affected by other factors, such as the inclusion of more special ed students, more students with English as a second language, more low income or poorer low-income students in their schools, and the like that may contribute to lower scores.

Table 9 reveals that those students with DI experience are more likely to be poorer, more likely to have limited English proficiency, a little more likely to be a minority, and more likely to be mobile (if a student had limited years of exposure to DI). All of these differences are likely to contribute to lower levels of student achievement among DI students. On the other hand, all groups are similar with regard to daily attendance rates. Those with five years of DI are a bit more similar to those with no DI, but there still are notable differences.

TABLE 9 SELECTED CHARACTERISTICS OF LOW-INCOME STUDENTS, FOURTH GRADE, BY YEARS OF DI, 2003-04

	Years of Direct Instruction			
Characteristics	**0**	**1 or 2**	**3 or 4**	**5**
% Free Lunch (only)	84	89	89	88
% Limited English	12	13	22	21
% Special Education	18	20	17	14
% White	10	5	5	8
% 1 school attended in 3 yrs	80	53	72	82
% Attendance Rate 2003-04	94	93	94	94
Number of Students	2109	699	589	260

Source: MPS Special Data Run

Another point to acknowledge with regard to DI is that despite higher levels of achievement among poor students with five years of DI, their average scores (639 in reading) are still considerably below those of higher income students with no DI exposure (648 in reading). The gap is narrowed but not closed among the general population with DI. What we will examine below is whether those low-income children in schools that have fully implemented DI in terms of curriculum and amount of additional training provided annually come closer to closing that achievement gap across income groups.

When we examine the fifth grade for the impact of income and exposure to DI, there is a similar pattern to that found among fourth graders: the non-poor consistently score higher. We also see that those poor exposed to five years of DI do better in reading than the poor with no DI exposure (651 v. 647), but those with no DI and those with five years of DI did about the same in math (628 v. 627). In fourth grade, the reader will recall a slight difference the other way on math. We cannot conclude too much from this reversal, given the differences in populations among the poor. But it does suggest that DI math may not have been as well implemented initially and that the fourth graders who followed may have benefited from greater teacher experience. It also strongly suggests the need to take into account a number of different factors when trying to assess the impact of DI or any similar program.

Among those eligible for subsidized lunch, we next examine what impact DI has had on another measure, the proportion of students who are “proficient” or “advanced” in their scores (Table 10). This gets at the distribution of scores rather than the average. What the table shows are the percentages of fourth and fifth graders who scored in each of four competency categories on the fourth grade WKCE exam. These distributions are separated by the years of exposure to DI. Rather than the detail seen previously, we have compacted those with three or more years of DI. We also compare those to non-subsidized students to see what gaps remain.

The four categories of competency range from Minimal to Basic to Proficient to Advanced Proficiency. Among low-income students, a higher proportion of students with three or more years of DI (18%) are ranked as Advanced when compared to those with no DI experience (12%) on math. The difference is significant and suggests a real contribution from DI. On the other hand, on reading, equal proportions (18%) are ranked in the Advanced category.

When the proportions of students with Proficient designation are compared for either math or reading, however, the proportion of those with no DI exposure exceeds that with three or more years of DI on both math and reading.

Table 10 Combined WKCE Fourth Grade Proficiency Distribution for MPS on Math and Reading Among Low-Income Students by Exposure to DI, 2002-04

	Percent Scores by Years of Direct Instruction			
	0 years	1-2 Years	3+ Years	No DI
Math				
Minimal	33	37	37	16
Basic	17	16	15	12
Proficient	39	37	30	45
Advanced	12	11	18	27
N =	4358	1420	1253	1608
Reading				
Minimal	9	10	12	3
Basic	24	26	25	10
Proficient	49	48	44	43
Advanced	18	16	18	44
N =	4319	1412	1241	1600

Source: MPS Special Data Run

income students score markedly higher. This is a bit surprising, given the advanced distribution. It suggests that more detailed analysis is needed to try to uncover some other factors that may be contributing to the somewhat unexpected results.

Before looking at other characteristics, what must also be noted is the vast difference in distributions across all four competency levels between low and non-low-income, regardless of the use of DI. The achievement differences are very pronounced between those with higher and lower incomes. Just like the scale scores, non-low-

Ethnicity

Another way to look at differences among the students and the impact of DI on their education outcomes is to see if there is a different impact depending on the ethnicity of the individual student. Again, it may be more than ethnicity, but we will examine this as a proxy for several other possible characteristics, such as English as a second language, differential rates of students being designated as needing special education, different incomes or family situations, student mobility, and other factors that may contribute to educational outcomes. We examine some of these below, but first we look at differences by ethnicity.

We originally identified six ethnic groups within MPS. But three of them, Native American, Asian, and Other, have very limited numbers of members who have exposure to DI, so we do not include them in this more detailed analysis. Instead we focus on Black, Hispanic, and white, but even the white group is small for analysis. We saw above that there are different levels of achievement by ethnic group. The question this section tries to answer is whether there are differential gains in achievement by ethnicity related to the degree of exposure to DI among low-income students. In examining Table 11 we see that there do seem to be some differences in the impact of DI.

Looking first at those low-income, fourth graders with no DI, the white students scored substantially higher than Blacks or Hispanics on both math and reading. The differences in reading were markedly higher than on math. Black and Hispanic students that were exposed to less than five years of DI did not do as well as those without DI. Again, this might be explained by the many other factors not accounted for by just notation of one's ethnicity. But in both groups those with five years of DI scored better, on average, than those with no DI, with the one exception of Hispanics on math (63 cases). These results suggest that DI has added value when minority students are exposed long term. In three of the four cases, five years of DI added three or four points to the scale scores, among those who are very likely poorer than those with no DI experience. That is a positive statement about DI, and DI appears to have worked about the same with both ethnic groups.

TABLE 11 AVERAGE SCALE SCORES FOR MATH AND READING AMONG LOW-INCOME STUDENTS BY ETHNICITY AND EXPOSURE TO DI, GRADES 4 AND 5, 2003-04

	Math			Reading		
Fourth Grade						
Years of DI	**Black**	**Hispanic**	**White**	**Black**	**Hispanic**	**White**
0 yrs	612	619	626	624	625	640
1-2 yrs	606	617	618	619	627	645
3-4 yrs	609	608	641	623	613	641
5 yrs	616	617	643	628	628	643
Fifth Grade						
Years of DI	**Black**	**Hispanic**	**White**	**Black**	**Hispanic**	**White**
O yrs	623	633	644	644	648	657
1-2 yrs	615	627	636	638	644	656
3-4 yrs	620	632	634*	642	651	644*
5 yrs	625	NA	648*	648	NA	671*

* means between 15 and 50 students
NA means fewer than 15 students

Source: MPS Special Data Run

At the fifth grade level, we can only really look at Black scores. (There were only five Hispanic and 16 white, low-income students that had had DI for five years.) Among African Americans, five years of DI resulted in a two-point average gain in math and four points higher in reading. DI again appears to have made a notable difference in outcomes. This occurred even though these groups are not similar with respect to such things as income, English proficiency, and, for those with one to four years of DI, school stability (Table 12).

The message in Table 12 (next page) is that there are several differences likely to affect educational outcomes among low-income Black and Hispanic students. Although students with no DI and five years of DI are the most similar on several characteristics, those with five years of DI are generally poorer (a higher percent qualify for a totally free lunch), and more Hispanics have limited English proficiency. On the plus side, those with five years of DI are more stable in terms of having attended but one school the last three years. But there is a large difference in this number between Blacks and Hispanics, thus suggesting a factor contributing to lower Black levels of achievement. There is also a higher incidence of special education among Blacks, also partially explaining the lower average scores for this ethnic group.

Regardless of these different characteristics among low-income students, five years of DI consistently yielded higher reading scale scores than those who had either fewer years of DI instruction or who had had no DI instruction. These differences are most robust among African American children eligible for the subsidized-lunch program. The same appears to be true for Hispanic and white children, but the sample sizes are too small to be sure.

COMPLETE IMPLEMENTATION OF DI

DI is not just a curriculum. It is a method and style of teaching, as well. Teachers can be exposed to the curriculum, but they are not likely to implement it well without continuing instruction on the best methods of employing the curriculum and working with students. Those schools that have the resources and invest them in the continuing development of DI instruction skills tend to do better than schools that do not invest as heavily in the continuing training of the teaching staff.

To test the hypothesis that complete implementation of DI that involves a full complement of teacher training adds to achievement levels, we tried to examine the results for the schools that were said by MPS DI staff to be "com-

Table 12 Characteristics of Low-Income Black and Hispanic Fifth Grade Students by Years of Exposure to DI, 2003-04

	Hispanic				Black			
	Years of Direct Instruction				Years of Direct Instruction			
Characteristics	0	1-2	3-4	5	0	1-2	3-4	5
Fourth Grade								
% Free Lunch (only)	86	89	89	89	87	92	92	93
% Limited English	48	47	61	73	0	0	0	0
% Special Education	14	14	16	11	19	23	19	15
% 1 school attended in 3 yrs	87	66	89	95	76	49	61	75
% Attendance Rate 2003-04	94	94	95	95	94	93	93	93
Number of Students	333	129	165	63	1365	479	344	166
Fifth Grade								
% Free Lunch (only)	86	87	75	NA	87	92	93	93
% Limited English	41	48	53	NA	0	0	0	0
% Special Education	17	12	10	NA	22	22	26	21
% 1 school attended in 3 yrs	88	81	86	NA	80	53	62	82
% Attendance Rate 2003-04	94	94	95	NA	94	93	93	94
Number of Students	402	223	77	5	1350	526	221	178

Source: MPS Special Data Run

plete" implementation. Unfortunately, there are very few (3) such schools in MPS to examine. When we look at the number of students at the fourth and fifth grades, especially the number of low-income students, we find that only 48 fourth-grade students and 54 fifth-grade students have had the experience of complete implementation of DI.

We examined the outcomes to see what they might suggest (Table 13). At the fourth grade in 2003-04, low-income students attending schools with "complete" implementation of DI (no set number of years of exposure), scored 621 in math and 627 in reading compared to 610 and 622 among low-income students attending schools in 2003-04 with less than complete DI offerings. Those low-income students in schools with complete DI scored higher than low income with no DI on both reading and math, but substantially higher on math (621 to 616). Those differences suggest that implementing DI the way it was intended does lead to higher levels of achievement. These numbers help to support the case for fuller implementation of DI to achieve better student outcomes.

Table 13 Average Scale Scores For Reading and Math Among Low-Income Fourth and Fifth Grades by Completeness of DI, 2003-04

	Math			Reading		
	Complete DI	Some DI	No DI	Complete DI	Some DI	No DI
Fourth Grade	621	610	616	627	622	626
Fifth Grade	647	622	628	654	648	647

At the fifth grade, those 54 low-income students enrolled at complete DI schools scored an average of 647 in math and 654 in reading compared to those low-income students at other DI schools who scored 622 and 648, respectively. Again, the more complete implementation is associated with better results. What may be more surprising to some readers is that the low-income students in the complete implementation schools scored markedly higher, on average, than those with no DI.

While true to a modest degree overall, the differences are exaggerated: math scores were 647 v. 628 and reading was 654 v. 647. Caution is urged, however, because of the small number of students in the "complete" DI schools. But the pattern does suggest that more complete implementation does make a difference.

Undoubtedly, the case would be stronger if more students had had the "complete" DI experience in other schools, and we could examine those with five years of experience at the "complete" DI schools. A hint of this is revealed with a look at the 22 low-income, African American students who had had five years of experience of DI and attended these schools in 2003-04. They scored, on average, 652 in math and 667 in reading. This is far higher than the average of all low-income students in MPS in fifth grade (626, math, and 646, reading). It is also higher than the averages for non-low-income students in math (646) and just below such students in reading (670). Unfortunately, the small number of such students makes the evidence less than statistically convincing. The math differences are statistically significant, but the reading differences are not. Nevertheless, the higher scores do suggest a strong program when one thinks of the many challenges this low-income African American population faces.

Complete DI appears to help low-income students, especially when the students have had the opportunity for five years of DI. These results, although limited in terms of number of students, strengthen the case of DI overall and for DI to be implemented completely in the schools serving low-income students (which is all schools in MPS).

Value Added

Another, and some think superior, way to examine the impact of DI is to compare the progress made (value added) between two years among students with DI to those who did not have DI. That is what we attempt next. What we use as a measure is the percentage change in scores, in math and in reading, between grades, either third to fourth or fourth to fifth among two cohorts of students. We are seeking to learn the degree to which varying amounts of DI lead to different rates of learning growth among the same children. The measure of change is the percentage change between scale scores for each individual. The basic question is whether more DI leads to greater year-to-year achievement gains.

Thus, the first comparison is the gain on math scores between third and fourth grades for those in fourth grade in 2003-04 (Table 14). Among low-income students, those with five years of DI gained 6.6% while those low-income students with no DI gained 6.0%, and non-low-income students with no DI gained an average of 4.7%. Those low-income students with lesser amounts of DI made gains, but only those with one to two years of DI did better than those with no DI. Some other factors are playing a role here that makes these gains inconsistent across years of DI. Nevertheless, the comparison of non-low-income to low-income with five years of DI shows a 40% larger gain for the low-income students with five years of DI. Among these several differences, only one is statistically significant: the difference between those with zero and those with five years of DI.

Table 14 Average Percentage Increase in Scale Math Scores Between Third and Fourth Grade for Fourth Graders in 2003-04 by Years of Direct Instruction

	Years of DI			
Income Level	**0**	**1-2**	**3-4**	**5**
Low Income (% gains):	6.0	6.2	5.5	6.6
Non-Low-Income (% gain)	4.7			

Most of the ethnic groups have populations too small to be worth examining. Only African Americans had a reasonably large number of students (192) exposed to five years of DI. Among the African American population, those with five years of DI had a 6.6% gain on math scores between 2002-03 and 2003-04. That was just slightly larger than that among all low-income students with no DI (6.0%) and those non-low-income black students with no DI (5.3%). Again, overall those with one to two years of DI did better than those with three to four years of DI, which is harder to explain, unless those with one to two years might have had DI more recently, have different characteristics from the three to four year DI population, were attending different schools, and other possible contributing factors. These are not easy differences to explain, and they are not statistically significant.

Among fifth graders in 2003-04, their changes between third and fourth grades resulted in more modest gains on math scores (Table 15). This may be due to less experienced teachers or a different mix of students, since all stu-

TABLE 15 AVERAGE PERCENTAGE INCREASE IN SCALE MATH SCORES BETWEEN THIRD AND FOURTH GRADE FOR FIFTH GRADERS IN 2003-04 BY YEARS OF DIRECT INSTRUCTION

	Years of DI			
Income Level	**0**	**1-2**	**3-4**	**5**
Low Income % gains:	2.9	3.0	3.1	3.7
Non-Low-Income % gain	2.3			

dents experienced smaller gains. Nevertheless, having five years of exposure to DI led to slightly larger gains between the years on math: 3.7% for those with five years of DI compared to 2.9% for those with no DI. And all of those with DI experience gained more than those low-income with no DI and even the non-low-income with no DI. The rate of gain, among the low-income students with five years of DI was more than 60% greater than the gain among the non-low-income.

Math gains for the fifth graders between fourth and fifth grades were even more modest than between third and fourth grades (Table 16). Those with DI experience gained at a lower rate. Even those with five years of DI had an average gain of 2.1%. DI did not succeed the way it had with the other two comparisons. The lower gains may be attributable to inexperienced teachers or to different student characteristics. It is not what their previous year's gain would suggest. Nevertheless, when the more disadvantaged population (those exposed to DI) does as well as the others, the evidence suggests merit in the DI approach.

TABLE 16 AVERAGE PERCENTAGE INCREASE IN SCALE MATH SCORES BETWEEN FOURTH AND FIFTH GRADES FOR FIFTH GRADERS IN 2003-04 BY YEARS OF DIRECT INSTRUCTION

	Years of DI			
Income Level	**0**	**1-2**	**3-4**	**5**
Low Income % gains:	2.9	2.2	2.6	2.1
Non-Low-Income % gain	3.2			

Year-to-year reading gains were modestly larger than math gains among fifth graders (the only group for which comparisons could be made). Among those on subsidized lunch, three or more years of DI contributed to larger gains in reading scores (Table 17). Those low-income students with three to four years of DI gained 4.8% compared to 3.7% for those with no DI and 4.2% for those with five years of DI. Both groups out-gained the non-low-income population by 23% and 8%, respectively: the non-low-income students gained 3.9% in reading scores between fourth and fifth grades. When we examine the African American population, we find a similar pattern: those low-income with more DI had larger gains on reading than those with less or no DI. And those low-income students with at least three years of DI gained more than non-low-income Black students. Thus, more DI appears to lead to larger year-to-year gains among low-income students in reading. Although these differences are not statistically significant, they again reveal that the more disadvantaged students are doing at least as well as the more advantaged.

TABLE 17 AVERAGE PERCENTAGE INCREASE IN SCALE READING SCORES BETWEEN FOURTH AND FIFTH GRADE FOR FIFTH GRADERS IN 2003-04 BY YEARS OF DIRECT INSTRUCTION

	Years of DI			
Income Level	**0**	**1-2**	**3-4**	**5**
Low Income % gains:	3.7	3.6	4.8	4.2
Non-Low-Income % gain	3.9			

The contrast between the math and reading gains among the fifth grade class suggests that DI, with its emphasis on phonics, does more for low-income students than alternative reading approaches, even in a population that is making limited math gains. Three of the four changes (third to fourth grade math for both classes and fourth to fifth grade reading) show larger gains for those with more DI exposure. This pattern does not appear on math gains from fourth to fifth grades, even though it did for the same population between third and fourth. It may have something to do with DI math instruction in fifth grade or with the use of DI math at some point in the past. The differences are not large, but they are clearly in a different direction. It is difficult to know or to learn why this result occurred. The evidence on value-added reading gains is consistent: DI does help the more disadvantaged low-income students at least match the gains of others.

THE IMPACT OF SPECIAL EDUCATION

One of the strongest associations with higher scores is with non-special education students. In regression after regression, the strongest factor in explaining test results is the role of special education: those who do not need it do markedly better than those who have been assessed as needing special education interventions. Because of this and because there are varying-sized special education sub-populations within the group of students that we have been analyzing, we look at them specifically with regard to the use of DI.

One of the first points to note is the proportion of students assigned to special education. About 17% of MPS students are labeled as Special Education students (Table 18). There are nine different categories of need, but these are all included in this count. DI is often used with special education students because of its success with this population. In fact several schools are using DI with all students because of the progress teachers made using DI with their special education students. Regardless, special education students tend to score considerably below regular education students on standardized tests.

TABLE 18 NUMBER OF STUDENTS WITH SPECIAL EDUCATION AND REGULAR EDUCATION TEST SCORES, 2003-04

	Special Ed Math & Reading	Regular Ed Math & Reading	% Sp.Ed.	Total
Fourth Grade	763	3936	16	4699
Fifth Grade	801	3761	18	4562

If we take a quick look at the average score differential between special education and regular education students in 2003-04, we see that in fourth grade, those low-income students in regular education scored 23 points (3.9%) higher than special education students on math and 38 points higher (6.4%) on reading. Thus, it is clear that including special education students does affect achievement outcomes to a considerable degree.

	Math	Reading
Fourth Grade, Low-Income Special Education	594	593
Fourth Grade, Low-Income Regular Education	617	631

But the relative impact of this inclusion might not be so great if the proportion of special education students in the different programs is similar. We know from Table 12 above that it is not: for example, African American students are more likely to be classified as needing special education and to have had some exposure to DI than have others. Therefore, we should examine DI results among just those students in regular education to see if it affects our results.

When we look at the fourth and fifth grade average scores among low-income students in regular education (Table 19), we see some interesting outcomes. Among those with no DI, those in regular education scored an average of 619 in math and 632 in reading. (These scores are higher than those for all low-income students with no DI experience, 616 and 626 respectively.) Those with five years of DI scored just above that: 620 in math and 633 in reading. Those with some but less DI did not score quite as well. So the benefits of five years of exposure to DI are also present; the difference, however, is not very large at fourth grade.

TABLE 19 AVERAGE SCALE SCORES ON READING AND MATH, FOURTH AND FIFTH GRADES, 2003-04, AMONG LOW-INCOME, NON-SPECIAL EDUCATION STUDENTS, BY YEARS OF DIRECT INSTRUCTION

	Years of DI			
	0 years	1-2 years	3-4 years	5 years
Fourth Grade Math	619	616	613	620
Fourth Grade Reading	632	631	629	633
Fifth Grade Math	634	626	631	634
Fifth Grade Reading	655	649	654	660
Number of students	1728	705	280	181

Source: MPS Special Data Run

The low-income fourth graders, despite seemingly being similar, are not (Table 20). Those

exposed to DI were different. For example, the DI population is considerably poorer (77%-79% eligible for a free, not just a reduced-price, lunch, which is 19 to 21 percentage points more than those with no DI experience). The DI population with three to five years of DI had more than twice the proportion of those with limited English proficiency (22% versus 10% for those with no DI). Those with DI experience included a higher proportion of the students that are minority. And while those with five years of DI were just as stable as those with no DI, those students with one to four years of DI changed schools with considerably greater frequency over a three-year period. These differences help to explain more of the variation in outcomes. The differences also reveal that DI helps more disadvantaged students at least match academic outcomes with those of more advantaged students.

TABLE 20 SELECTED CHARACTERISTICS OF LOW-INCOME REGULAR EDUCATION STUDENTS BY YEARS OF DIRECT INSTRUCTION

	Years of Direct Instruction			
Characteristics	**0 Years**	**1-2 years**	**3-4 Years**	**5 Years**
Fourth Grade				
% Free (only) Lunch	58	77	79	79
% Limited English	10	14	22	22
% White	22	8	7	12
% 1 School in 3 yrs	82	54	72	82
% Attendance 2003-04	95	94	94	95
Number of Students	2496	648	540	252
Fifth Grade				
% Free (only) Lunch	59	77	73	75
% Limited English	8	15	16	NA
% White	20	7	8	12
% 1 School in 3 yrs	85	67	76	85
% Attendance 2003-04	95	94	94	95

Source: MPS Special Data Run

Among the fifth grade, low-income, regular education students, DI students with five years of DI did as well on math (634), on average, and better on reading (660 compared to 655). Thus, there is good evidence that over time five years of DI does add substantial value among the low-income population on reading. These higher scores appear despite the students being exposed to DI more commonly having characteristics that have been associated with lower test scores, just like the fourth grade DI students. In other words, Direct Instruction is adding notable value to the educational achievement of low-income students in Milwaukee, especially if the students have long-term exposure to the curriculum. And this is most true with regard to reading skills: the DI use of phonics reflects the science showing that students learn more with this approach to reading.

CONCLUSION

The data confirm what school principals and teachers who use DI claim: DI helps to raise student achievement levels, especially on reading. The proof is in the numbers as well as the experience of the teachers. There is a good deal of evidence that DI adds value. The percentage difference between DI and non-DI educated students' achievement levels is not always large. But there are a number of reasons that help to explain why the numerical gap is often modest; the comparisons that we are able to do are limited and often do not allow us to compare exactly similar groups in similar situations. In other words, when we compare DI students with non-DI students, they are not the same. DI students tend to be poorer, many have been more mobile, more students have limited English proficiency, and the like, all conditions that are associated with lower achievement levels. Despite these many challenges, students with long-term exposure to DI usually do better, on average, than students with more advantages.

In a school system with a largely disadvantaged population the use of DI seems warranted. DI results demonstrate that DI can help all income groups. In fact, it often helped to raise achievement levels among the non-poor even more than among the poor population of students. But DI often does provide higher scores among low-income stu-

dents who are exposed to DI for a longer time period — in this study, five years. This is especially true for certain ethnic groups, notably Black and Hispanic.

Making this case is not easy because of the many factors that influence educational outcomes. But when subelements of the student population, such as the low-income population, are analyzed for both reading and math, the evidence is quite clear that DI, when implemented for an extended period, adds value. This is most clear for reading. It is not consistently the case with math. But that may be due to other factors playing larger roles. That is too complex a subject for this paper. Nevertheless, the fact that the outcomes among the more disadvantaged are at least as good as among the less disadvantaged indicates DI is helping these students.

Among the low-income population, reading scores for those students with five years of DI exceed those of others who have had no DI exposure as well as those with fewer than five years of DI. Year-to-year gains among the same students are greater. The proportion of students scoring on the "advanced" level in math is greater. And if DI is done not only in every grade but also with complete support in terms of teacher continuing education on DI, the differences are even more pronounced.

Some readers may want to argue that the reason those with five years of DI do better is because they are more stable students — they have been able to stay at the same school for at least three years and likely five years. While stability appears to contribute, it may well be that the students have stayed at these schools because they are learning well how to read and do math. Those who switch schools often include students whose families are looking for schools in which their children can succeed. DI has allowed many such students to succeed at levels above those of their similar counterparts.

It appears that, with the current fiscal pressures on schools, complete support (meaning DI starting at kindergarten and continuing at least through fifth grade, and continuous professional development for teachers) for DI is not common. That is unfortunate, given the additional gains realized at the schools that have accomplished this. But even without that level of support, students with five years of DI do better, on average, than those who had less than five years of DI. The results of this study should strengthen the case for additional instructional support for DI in MPS.

Not only are there financial barriers to the expanded use of DI, there are other hurdles to overcome. Among them are teacher reluctance, the absence of DI instruction in our colleges and universities, the lack of acceptance of the years of research that show that DI works, especially for children at risk, and the school commitments to continuous professional development. These are not easy hurdles to jump, but the evidence on DI suggests that the payoffs are worth the effort.

Besides being an endorsement of Direct Instruction, the often higher scores in reading among DI students reinforce the basic science of learning findings that indicate that phonics-based instruction in reading is critical to higher levels of reading achievement. If DI is to show even greater levels of student achievement, especially for low-income students, it must be more fully supported by MPS and the education establishment. DI needs to be taught in area colleges and universities. DI needs to be a much greater part of professional development in all schools that employ it. MPS needs at least three other DI literacy specialists to help teachers better learn and stay on top of their DI skills. If more schools elect DI, the need for more professional development assistance will be even higher.

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