CATCHING UP
Impact of the Talent Development Ninth Grade Instructional Interventions in Reading and Mathematics in High-Poverty High Schools

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Report 69

April 2004

This report was published by the Center for Research on the Education of Students Placed At Risk (CRESPAR), a national research and development center supported by a grant (No. R117-D40005) from the Institute of Education Sciences (IES, formerly OERI), U.S. Department of Education. The content or opinions expressed herein do not necessarily reflect the views of the Department of Education or any other agency of the U.S. Government. Reports are available from: Publications Department, CRESPAR/Johns Hopkins University; 3003 N. Charles Street, Suite 200; Baltimore MD 21218. An on-line version of this report is available at our website: *www.csos.jhu.edu*.

THE CENTER

Every child has the capacity to succeed in school and in life. Yet far too many children fail to meet their potential. Many students, especially those from poor and minority families, are placed at risk by school practices that sort some students into high-quality programs and other students into low-quality education. CRESPAR believes that schools must replace the "sorting paradigm" with a "talent development" model that sets high expectations for all students, and ensures that all students receive a rich and demanding curriculum with appropriate assistance and support.

The mission of the Center for Research on the Education of Students Placed At Risk (CRESPAR) is to conduct the research, development, evaluation, and dissemination needed to transform schooling for students placed at risk. The work of the Center is guided by three central themes—ensuring the success of all students at key development points, building on students' personal and cultural assets, and scaling up effective programs—and conducted through research and development programs in the areas of early and elementary studies; middle and high school studies; school, family, and community partnerships; and systemic supports for school reform, as well as a program of institutional activities.

CRESPAR is organized as a partnership of Johns Hopkins University and Howard University, and is one of twelve national research and development centers supported by a grant (R117-D40005) from the Institute of Education Sciences (IES, formerly OERI) at the U.S. Department of Education. The centers examine a wide range of specific topics in education including early childhood development and education, student learning and achievement, cultural and linguistic diversity, English language learners, reading and literacy, gifted and talented students, improving low achieving schools, innovation in school reform, and state and local education policy. The overall objective of these centers is to conduct education research that will inform policy makers and practitioners about educational practices and outcomes that contribute to successful school performance.

ABSTRACT

Concerns that higher standards and demanding high-stakes tests will disadvantage students who have attended weak, unsuccessful, or under-resourced schools have typically been met with the counter-claim that poorly prepared students will be provided with the extra help and support they need to succeed. Efforts to provide extra help are in their infancy, however, and very little is known about the feasibility and pace of accelerating the academic learning of students who enter high school multiple years behind grade level.

This study uses multiple regression analyses of standardized test and survey data from high-poverty high schools in two large urban districts to evaluate initial impacts of the Talent Development High Schools (TDHS) ninth grade instructional program in reading and mathematics. Pre-post and match-control comparisons show that students in the TDHS schools significantly outperformed students in the control schools in mathematics and reading achievement gains, controlling for their prior achievement, attendance, age, and gender. Students in TDHS schools also passed Algebra 1 at higher rates. Achievement advantages occurred at all levels of prior achievement, and gains occurred despite less than perfect implementation and in the face of considerable implementation challenges. Supplemental surveys show a higher percentage of students in the TDHS schools reported learning new skills, strategies, and concepts, and TDHS teachers indicated they were able to use more varied activities during extended periods, use cooperative learning strategies, engage students in group projects, and have students present multiple solutions or methods and relate their academic work to real world experiences and examples.

ACKNOWLEDGMENTS

The authors thank Drs. Ruth Neild and Betsey Useem for their reviews of an earlier version of this report.

INTRODUCTION

Over the past 20 years, high school promotion and graduation requirements have increased significantly and recently many states and districts have further intensified their efforts to ensure that all students leave high school with the knowledge and skills needed for adult success by instituting standards based end-of-course and graduation exams (Committee for Economic Development, 2000). Concerns that raising standards and instituting high-stakes tests will disadvantage students who have attended weak, unsuccessful, or under-resourced schools have typically been met with the counter-claim that poorly prepared students will be provided with the extra help and support they need to succeed (Achieve, 2001). To date, most of the support has centered on giving poorly prepared students more time. This has included providing second-chance test prep during summer school, offering students a fifth year of high school to become prepared, and attempting to enroll students in transition programs until they are ready to do high school level work.

Much less attention has been given to developing curricular and instructional means for poorly prepared high school students to accelerate their learning during the school year. A few such efforts are in their infancy. Several whole school reform models for high schools are developing catch-up courses, and several school districts have developed special prep courses for poorly prepared students that are given during the school day in addition to the standard grade courses (Balfanz, McPartland, & Shaw, 2002). To date, however, in large part because of their infancy, the impact of these efforts has not been evaluated beyond small, formative studies typically involving a single school and one or two teachers. As a result, very little is known about the feasibility and rapidity with which the academic learning of students who enter high school multiple years behind grade level can be accelerated. This report takes a first step in this direction by reporting on the initial results and impacts of the Talent Development High Schools (TDHS) ninth grade instructional program in reading and mathematics. Its impact is examined across several cities and multiple high-poverty, non-selective high schools within each city.

The Need to Accelerate Learning in High-poverty High Schools

Analysis of existing achievement data in high-poverty high schools leads to two inescapable conclusions. First, students who attend high-poverty high schools typically perform significantly below national norms and dramatically short of the performance benchmarks increasingly employed to measure academic success. An analysis conducted by *Education Week* indicates, for example, that in the majority of large cities many students enter high school two or more years below grade level (*Quality Counts '98,* 1998). The recent TIMSS R study shows that cities that educate primarily high-poverty students typically have performance levels equal to those in developing countries (Mullis et al., 2001).

When data is disaggregated to examine achievement at the school level, even larger gaps are revealed. In Philadelphia, for instance, more than 75% of high school students attend one of 22 non-selective neighborhood schools. Approximately one quarter of these students are reading below the fifth grade level, another quarter is at the fifth or sixth grade level, a third quarter at the seventh or eighth grade level, and only slightly more than one in four students who attend a non-selective high school in Philadelphia read at grade level. In eight of the non-selective neighborhood schools, between two thirds and four fifths of the first-time ninth graders perform below the seventh grade level in both reading and mathematics (Neild & Balfanz, 2001).

One important conclusion that can be drawn from this data is that in many non-selective urban schools the majority, and in some cases nearly all, of the students need accelerated learning opportunities. What is required are not special programs for small numbers of students, but an organizational and instructional restructuring of the entire school, which will enable students to close achievement gaps and graduate prepared for college or post-secondary training (Legters, Balfanz, Jordan, & McPartland, 2002; McPartland & Jordan, 2001).

The second conclusion is that the current level of academic performance in high-poverty high schools leads to multiple negative consequences for students and for society. It is too early to accurately gauge the impact of the high-stakes, standards based graduation tests that are increasingly becoming the norm in many states on the academic performance and dropout rate of students who enter high school with weak academic skills (Bishop & Mane, 2000; Hauser, 2001). Several states at the forefront of this movement have recently slowed down their introduction, while in other states the first cohorts of students have not yet reached 12th grade. Nor is the impact of the minimum competency tests that were introduced primarily in the 1980s, and required in some states for graduation, unequivocal (Hauser, 2001). Existing data from Chicago (Roderick & Camburn, 1999) and Philadelphia, however, clearly show that poor academic preparation is a major factor in a downward path of course failure and retention that engulfs many high-poverty students during the ninth grade and culminates with them dropping out of school. Neild and Balfanz (2001), for example, found that 43% of the first-time freshmen in Philadelphia who entered the ninth grade with math and reading skills below the seventh grade level were not promoted to the 10th grade, compared to 18% of the students who entered with skills above the 7th grade level. Logistic regression analysis further demonstrated that below-grade-level academic skills had a significant negative impact on promotion to 10th grade, controlling for attendance, eighth-grade course failure, age, race, and gender. Neild, Stoner-Eby, and Furstenberg (2001) in a longitudinal study, in turn, found that first-time freshmen not promoted to 10th grade had a dropout rate of nearly 60% compared to a rate of less than 12% for students who were promoted.

The individual and social consequences of dropping out of high school are considerable. The economic returns to advanced education have been well documented (Committee for Economic Development, 2000). The social consequences of failing to complete high school are also

well established (Hauser, 2001). Balfanz and Legters (2001) estimate that there are about 250-300 high schools in the nation's 35 largest cities in which non-promotion is the norm. These schools are attended by about 60% of the African American and Latino students in public high schools in these cities. Thus, in an era when there is widespread consensus on the value of raising graduation requirements and standards, it is paramount that a means of accelerating student learning in high-poverty high schools be developed and evaluated.

What type of catching up and accelerated learning is needed in English and mathematics?

Grade level metrics and the percentage of students obtaining various proficiency levels provide a rough guide to the magnitude of catching up that needs to occur in high-poverty high schools. They do not, however, provide a good guide to the skills, knowledge, and habits of mind that high school students with poor preparation need to acquire in an accelerated fashion to succeed in standards based courses, pass high-stakes tests, and become prepared to enter college or post-secondary training without remediation. On these questions, existing literature is sparse (Balfanz, McPartland, & Shaw, 2002).

There is a small, but growing, body of work that indicates that, concerning adolescent literacy, the greatest need is developing students' reading comprehension and fluency (National Reading Panel, 2000). Nearly all adolescents can decode, but significant numbers of entering high school students have weak or limited reading comprehension skills (Campbell, Hombo, & Mazzeo, 2000). In high-poverty high schools, the number of students who struggle to decode is higher than average but still typically represents a small minority of students. The overriding challenge in high-poverty high schools is that most, if not nearly all, students struggle to comprehend and fluently read high school level material (Greenleaf, Schoenbach, Cziko, & Mueller, 2001).

There is nothing approaching agreement in mathematics. Here there are several strongly held divergent views and only recently have there been attempts to use research to sort out differences and forge a consensus (Kilpatrick, Swafford, & Findell, 2001). One view holds that pre-collegiate mathematics is a sequential subject with a defined core of knowledge and procedures that need to be mastered in a largely prescribed order. Remediation efforts center on locating where a student lies on this continuum and providing instruction and practice around a set of defined procedures. In short, this view holds that arithmetic needs to be mastered before a student can learn algebra. An alternative view holds that mathematics is a sense-making activity that employs a series of quantitative, algebraic, and geometric tools to solve problems. Kilpatrick, Swafford, & Findell (2001) find that this view proposes a different slant on accelerating learning that stresses both access to more advanced forms of mathematical thought and experience with

mathematical problem solving. Recently, as witnessed by the revised National Council of Teachers of Mathematics (NCTM) standards (2000), there have been some attempts to argue that students need to both acquire and learn how to apply a core of mathematical knowledge.

What is clear is that the type of accelerated learning required by poorly prepared students in high-poverty high schools needs to involve more than narrow test preparation. It has to be substantial and sustained and enable students to rapidly develop declarative, procedural, and metacognitive knowledge (Kilpatrick et al., 2001). It also has to motivate students to learn and take advantage of the strengths they bring to the classroom. For example, adolescents with weak reading comprehension skills often have substantial spoken vocabularies and oral language skills. Data collected as part of this study illustrate the uneven nature of the prior mathematical knowledge that poorly prepared students bring to the classroom. Entering ninth grade students in two high-poverty, non-selective high schools were given public release items from recent NAEP and TIMSS examinations. The results indicate that on any given item a substantial number of these students were successful, but overall, few students could solve more than a quarter of the items. In short, some students had decent prior knowledge of geometry but not of data or operations, while others could solve operations problems but not the geometry questions. Thus, it is not surprising that traditional remedial courses that assume all students need to be taught from square one often result in high rates of student frustration. (Greenleaf et al., 2001).

Existing Research on Attempts to Accelerate Secondary Students' Learning

Although many high schools offer some form of remediation in mathematics and reading, these efforts are typically not grounded in a well-developed research base or supported by solid evaluations of effectiveness. There are only a handful of catch-up programs for high school students that are supported by current research on the needs of adolescents and for which some evaluation data exists.

There are several recently developed extra-help or catch-up reading courses for high school students who can decode but who have weak fluency and struggle to comprehend advanced texts. These programs that focus on teaching students explicit reading comprehension strategies and giving them opportunities to apply these new skills have shown initial promising results. In high implementing classrooms, students typically gain two years of reading level over one year of instruction. To date, however, these programs have been tested with only limited populations of students. Typically, these studies have examined the impact of the reading course at the teacher level with primarily one to two experimental teachers compared to a similar number of control teachers (Allen, 2001; Codding, 2001; Fischer, 1999; Greenleaf et al., 2001; Raiche & Showers, 2000; Showers, Joyce, Scalon, & Schnaubelt, 1998).

The research and evaluation base is even smaller in mathematics. White, Porter, Gamoran, and Smithson (1997) found generally positive effects for three high school transition courses they examined. Each of the courses—Math A in California, Stretch Regents in Rochester, New York, and the University of Chicago School Mathematics Project (UCSMP) Transition text as used in Buffalo, New York—attempted in somewhat different ways to provide under-prepared students with the knowledge, skills, and approaches they needed to succeed in college preparatory courses. To a significant degree, they succeeded. White and colleagues found that students who took these transition courses were "much more successful than those in the general math track in obtaining college preparatory math credits" (p. 77) and showed greater achievement gains.

Beyond this single study, however, no other evaluations of high school catch-up courses in mathematics were found. Some school districts are trying different variations of providing some or all students with extra time and/or extra support to learn algebra and other college preparatory mathematics courses. But to date, the impact of these efforts has been reported primarily anecdotally (Olson, 2001). The one major exception is Equity 2000—a major effort launched by The College Board to dramatically increase the number of minority students taking algebra and geometry. The program was field tested throughout the 1990s in a number of urban school districts. Evaluations of Equity 2000 indicate that the elimination of lower or general track math courses, combined with sustained professional development for teachers and modest student supports primarily in the form of Saturday academies, enabled substantially more students to take and pass algebra and geometry (Everson & Dunham, 1996; Fields, 1997). The evaluations also indicate, however, that in several of the field test districts, only slightly more than half the students taking algebra and geometry passed and that the extra help provided through the Saturday academies was not a strong enough support for many students (Ham & Walker, 1999).

The Talent Development High School (TDHS) Ninth Grade Instructional Program

The TDHS ninth grade instructional program is specifically designed to accelerate the learning of poorly prepared students. It has four major components:

1. Ninth graders receive a double dose of math and English instruction in the context of a 4 x 4 block schedule. This means they take math and English 90 minutes a day for the whole year.
2. During the first semester, students take three research-based courses designed to enable them to overcome poor preparation and succeed in standards based high school courses. These courses are Strategic Reading, Transition to Advanced Mathematics, and Freshman Seminar. During the second semester, students take Algebra 1, English 1, and U.S. history along with either science or an elective.

3. Teachers receive intensive and sustained professional development and implementation support. This includes 25 to 30 hours of course-specific professional development and weekly non-evaluatory, in-classroom curriculum coaching from school district teachers on special assignment and JHU instructional facilitators.

4. This instruction takes place in a Ninth Grade Success Academy. Ninth graders are located in a separate part of the school building with their own academy principal. Students are then taught by a team of teachers who have a common planning period to coordinate student outreach and recovery efforts.

The TDHS Ninth Grade Reading/English Interventions— Strategic Reading and Student Team Literature

Taught during the first semester, the TDHS Strategic Reading course uses four approaches to develop students' reading fluency and comprehension strategies:

1. **Teachers model the comprehension process** through "read-aloud/think-aloud" demonstrations, interspersing an oral presentation of a reading passage with oral reflections of how the reader is reacting to the author. Teachers reflect on specific comprehension strategies, such as relating material to personal experiences, predicting developments, noticing the writer's use of literary or textual devices, monitoring understanding for re-reading a section when necessary, and guessing word meaning or narrative development from the passage context. Students learn how to give read-aloud/think-aloud presentations using various comprehension strategies. This is derived from the principle that one important way students learn is by observing an expert's behavior, imitating it, and gradually incorporating such behaviors into their own repertoire.

2. **Teachers offer mini-lessons** on specific comprehension strategies and elements of the writer's craft for different genres of fiction, non-fiction, poetry, and plays. These lessons engage students in discovering a concept, such as an author's use of symbolism, or a strategy, such as skimming the subheadings and captions of an informative passage before reading. The mini-lessons link to either the read-aloud that preceded or the reading selections that will follow or both, so students are receiving reinforcement of a topic from several angles to facilitate learning.

3. **Students work in small, cooperative learning teams** on selected novels and plays to practice new vocabulary, and in paired reading activities to improve fluency and to discuss carefully constructed questions about the selection using different comprehension strategies. The selected novels and plays have characters, plots, or informational content of high interest to teenagers, but written at a reading level that will not frustrate their efforts. For each selection,

student teams use Partner Discussion Guides prepared by Talent Development (TD) that provide background information to set the context and motivate interest, cover new vocabulary to enhance student fluency for the reading list, present comprehension questions for discussion so students are focused on intended learning goals, and highlight literary devices relevant to the work.

4. **Strategic Reading provides time for self-selected reading or writing activities.** Each classroom has its own library of high interest fiction and non-fiction selections as well as learning stations for reading along with books on tape or for writing and vocabulary exercises. Self-selected reading is intended to increase students' fluency through practice in reading real books and articles. That is more likely to occur with student-selected materials that are of high interest.

The second term of ninth grade uses the district's own English I syllabus, supported by TD Partner Discussion Guides for the selected novels, plays, or non-fiction assignments, as well as our Talent Development Writing supplements that provide detailed "springboards" for different phases of the writing process for specific purposes.

The TDHS Ninth Grade Mathematics Interventions— Transition to Advanced Mathematics and Value-added Algebra 1

Transition to Advanced Mathematics covers five units often included in Pre-Algebra or in the first few weeks of Algebra 1, with an emphasis on the use of manipulatives and student discussions of math topics:

1. Patterns, Functions, and Introduction to Algebra;
2. Rational Numbers (including fractions, decimals, and percents);
3. Measurement;
4. Coordinate Geometry; and
5. Data, Statistics, Probability.

In each unit, students are challenged to think and make sense of what they are learning, including seeking connections between mathematics and the real world. Each lesson begins with a short "problem of the day" to help students with mental math and estimation to help build facility and self-confidence in their math reasoning skills. The lesson follows with multiple coordinated learning activities featuring hands-on experiences and the sharing of ideas. The second-term Algebra 1 district offering uses TD supplemental materials to emphasize understanding and reasoning.

RESEARCH STUDIES

During the 1999-2000 and 2000-01 school years, several studies examined the achievement impact of the TDHS ninth grade instructional interventions in reading and mathematics.

Main Study

Students in three non-selective neighborhood high schools in Baltimore used the field-test version of the TDHS ninth grade instructional program. Their performance was then compared to students in three matched control schools. Both the three experimental schools and the three control schools were drawn from nine non-selective neighborhood high schools in Baltimore. These schools have remarkably similar demographics and, unfortunately, have achieved remarkably similar weak outcomes over the last decade. Seven of the nine schools have been declared reconstitution-eligible by the state because of their low attendance, achievement, and graduation rates. The modal pattern across these high schools is attendance in the 70% range, with 60-80% of students missing more than 20 days per year, and 70% fewer seniors than entering freshmen four years earlier, with dropout rates of 50% or higher.

Implementation Context and Challenges

Despite high-level support from the school district for the study, a number of significant implementation challenges were encountered in the schools. Initially, the Chief Academic Officer directed four schools to participate in the field test. At the last minute, however, two of the schools were allowed to drop out when their principals, bowing to pressure from state reconstitution officials, argued that it was too risky for their school to abandon the more traditional test prep instruction their state monitor favored. As a result, an additional school was recruited to join the study after the school year began, which meant that students at this school did not receive the full treatment. At another experimental school, the study lacked the support of the English and math department heads. Throughout the year, they pressured the implementing teachers to supplement the TDHS instructional program with components of the school district's test prep curriculum.

Implementation Levels and Support

At School A, three English teachers taught Strategic Reading to all ninth graders, excluding self-contained special education students during the first term of the 1999-2000 school year. At School B, two reading teachers taught Strategic Reading to five sections of ninth graders (about one-third of the class), including a repeater class, during the first term and they taught an equal number of students (five more sections) during the second semester. In addition, one English

teacher integrated elements of Strategic Reading throughout the year. All of the teachers at School A and one of the teachers at School B interrupted the Strategic Reading curriculum for approximately three weeks to prepare students for the Maryland Functional Writing test. School C joined the study halfway into the fall term and because of the upcoming functional writing test did not begin instruction in Strategic Reading until December. During the second semester, all of the English teachers across the three schools attempted to infuse Student Team Literature into their English 1 instruction, with the exception of the second semester Strategic Reading classes at School B.

Overall, the TDHS reading interventions were used by eight teachers in three schools with 20 classes of regular education students. In addition, one special education teacher used the curriculum materials. Her students are not included in the achievement analysis, but her opinions about the course are included in the teacher survey results. Of the regular education teachers, one was rated a high implementer of the interventions, five as medium implementers, and two as medium-low implementers by the curriculum coaches who provided weekly in-classroom implementation support.

Seven of the teachers were teaching the TDHS ninth grade reading/English program for the first time. The eighth and highest implementing teacher had piloted elements of Strategic Reading the year before. Five of the eight teachers attended a two-day training at the start of the term and at least two of the four 2-hour follow-up workshops offered during the term. The three teachers at School C received a one-day training at the end of the first semester plus on-site support during their planning periods from their school-based facilitator.

Three teachers taught Transition to Advanced Mathematics to all ninth graders at School A during the first semester of the 1999-2000 school year. Three of the four math teachers at School B taught the course to all of their ninth grade math sections. The fourth teacher used elements of the course with just one section of students (her other sections were considered honors sections). The efforts of two of the teachers at School B were somewhat hampered by resistance from their department head, who insisted that they focus their efforts on preparing students for the Maryland Functional Mathematics test and teaching the school district's Algebra 1a-1b curriculum. One teacher at School C volunteered to implement the program but was not able to begin until December. In all of the schools, the last unit of the Transition to Advanced Mathematics course, which focuses on patterns, functions, and an introduction to algebra, was taught during the first month of the second term in lieu of the introductory chapters in the district's Algebra 1 text.

Overall, the TDHS mathematics interventions were used by seven regular education teachers across three schools with 16 classrooms of students. In addition, two special education teachers used the materials. Their students are not included in the achievement analysis presented

here but their views of the course are included in the teacher survey results. Four of the regular education teachers were rated as medium-high implementers, two teachers as medium-low, and one as low. All of the teachers, with the exception of the one at School C, participated in two days of training before the school year and at least two of the four 2-hour follow-up workshops offered during the first term.

Both the English and mathematics teachers in the experimental schools received weekly in-classroom implementation support from curriculum coaches who were BCPSS employees on special assignment to the TDHS program. These coaches spent two days per week at each school and provided support both in the classroom and during the teachers' planning periods. The implementation support ranged from co-teaching and modeling key components of the TDHS instructional programs to helping the teachers customize the curriculum to their classrooms to making sure the teachers had all the materials and supplies they needed. The coaches also worked with the department heads and principals to make sure that the TDHS course met local standards and prepared students for local high-stakes exams.

The Control Schools and Their Instructional Programs

At the three control schools, students also received a double-dose (90 minutes a day for the full year) of mathematics and English instruction. Each school designed its own first semester course, though all of them placed a heavy emphasis on preparation for the Maryland State Functional writing and mathematics tests. In mathematics, this meant concentrating on computation and learning formulas. One of the control schools used a remedial reading program based on the teaching of discrete reading and decoding skills, while the other two schools' teachers were allowed to develop their own courses as long as they incorporated the school district's test preparation materials for the state writing test. All three schools followed the school district's scope and sequence for English 1 during the second semester and employed a new English anthology recently purchased by the district. In all three of the control schools, ninth graders also attended ninth grade academies with dedicated sets of teachers. Finally, as seen in Table 1, students at the experimental and control schools were nearly identical in terms of ninth grade attendance, age, demographics, and prior achievement levels. Students in the experimental and control groups were also representative of the population that attends non-selective neighborhood high schools in Baltimore, except in one regard. Students at both the control and experimental schools who were in school on the day the posttest was given in May had attendance rates that were nearly 20 percentage points higher (87-89% in the experimental and control groups, compared to 70% for all students attending neighborhood schools). This indicates that the reported outcomes are for those students who attended frequently enough to be impacted by the reforms.

Table 1
Descriptive Statistics
for TDHS, Control, and All Non-Selective High Schools in Baltimore

	Math			Reading		
Average	**TDHS (n=140)**	**Control (n=233)**	**All (n=6,636)**	**TDHS (n=257)**	**Control (n=200)**	**All (n=6,636)**
Attendance Rate	89.5%	88.6%	70.0%	88.3%	87.8%	70.0%
Age	15.3	15.2	15.8	15.2	15.2	15.8
% Female	44%	48%	45%	55%	56%	45%
% Black	96%	81%	88%	90%	86%	88%
% White	3.6%	15.0%	11%	10%	10%	11%
Scale Score 8th Grade	625	631	651	625	626	647
Grade Equivalent 8th Grade	5.1	5.4	5.6	4.3	4.4	4.8
National Percentile 8th Grade	17.7	19.8	18.4	20.9	21.3	19.2

Data Collection

Students in both the experimental and control schools were given the abbreviated version of the CTBS-5 Terra Nova achievement test in reading and mathematics in February and May. Students received a letter describing the purpose of the tests and giving them the option not to participate. Students who attended and made an effort to complete the exam received small incentives (e.g., notebooks) at each test administration. We were unable to obtain approval from the participating principals to give a pretest in September, so student scores on the district-administered CTBS test given in the fall of eighth grade (to assist in placing students in selective high schools) were used to measure prior achievement. In addition to the achievement tests, students in the experimental and control schools and teachers in the experimental schools completed short surveys in February. Finally, the schools' performances on the state functional exams were collected from published sources and school records data were used to calculate Algebra 1 pass rates.

FINDINGS

CTBS Achievement Tests

Regression analysis (OLS) was used to examine the impact of the TDHS instructional program at three time points: from eighth grade to February of ninth grade, from eighth grade to May of ninth grade, and from February to May of ninth grade. The first comparison provides an indication of the achievement impact of the first semester TDHS catch-up courses (Strategic Reading and Transition to Advanced Mathematics). The second comparison indicates the achievement impact of the full TDHS ninth grade instructional program in English and mathematics, and the last comparison is used as a cross-check against unknown differences in the eighth grade experience of the tested students. For the math analysis, School C was dropped because only one teacher agreed to participate (when the school was approached after the start of the school year

because other sites dropped out) and did not begin implementation until December. The English teachers for School C were kept in the analysis because three of the four ninth grade English teachers agreed to participate and significant elements of the TDHS reading intervention were woven into their second semester English 1 classes.

For both the eighth grade to May and February to May comparisons, students in the experimental schools significantly outperformed students in the control schools, in terms of both overall level of achievement obtained and in achievement gains. This remained true when a number of control variables were entered into the equation. Tables 2 and 3 show the results for the equation that included all the control variables that were found to be significant (gender, student age, ninth grade attendance, and prior achievement). The only comparison for which no significant difference was found was achievement gains from eighth grade to February. This may indicate that students needed to be exposed to the full year of treatment before significant differences emerged, or it may be a factor of the late start in English implementation in School C and the fact that schools continued to use the Transition to Advanced Mathematics curriculum into the second semester. The fact that students in the TDHS schools had a highly significant achievement advantage between February and May also indicates that the overall eighth grade to May gain was not primarily the result of unknown difference in the eighth grade experience of experimental and control students.

The achievement impacts of the TDHS ninth grade instructional program were educationally substantive. The effect size for the eighth grade to May gain was .28 for reading and .18 for math. This compares favorably to the effect sizes found in prior studies of achievement growth in high school. Also, comparison of the Betas in the regression equations shows that participation in the TDHS instructional program had an impact on par with improved attendance and being on-age for grade. Overall, as seen in Table 4, students who took the TDHS instructional program outperformed students in the control schools by a half year more in grade equivalents, 7 national percentile points, and 11 scale score points in mathematics, and 7 months in grade equivalents, 6 national percentile points and 12 scale score points in reading.

Achievement Gains by Prior Level of Achievement

Table 5 shows the percentage of students by prior achievement level who made large achievement gains (10 percentile points or higher) in mathematics and reading in both the TDHS and control schools. These results indicate that students at all levels of the achievement spectrum benefited from the TDHS ninth grade instructional program and that at each level of achievement, in all cases but one, a greater percentage of students in the TDHS schools obtained larger achievement gains. This is potentially a very significant finding because it indicates that a focus on teaching reading comprehension strategies and math problem-solving skills might benefit all

or most students at the start of ninth grade in similar schools. As a result, it might be more appropriate to view the first-term TDHS courses as accelerated learning opportunities rather than catch-up or remedial courses only appropriate for students multiple years behind grade level.

Table 2
Achievement Levels TDHS vs. Control

	8th Grade to May			8th Grade to February		
	Coefficient	**Beta**	**t***	**Coefficient**	**Beta**	**t***
MATH						
Intercept	290.05**		5.46**	310.65**		5.33**
Prior	0.54**	.55**	12.74**	0.53**	.48**	11.45**
Female	-10.63**	-.13**	-3.07**	-6.27	-.07	-1.65
Age	2.53	.04	0.87	1.16	.02	0.36
Days Absent	-3.06*	-.08*	-1.94*	-5.06**	-.12**	-2.93**
Quartile						
TDHS	8.35*	.09*	2.07*	-7.02	-.07	-1.59
READING						
Intercept	493.02**		9.62**	383.27**		8.39**
Prior	0.45**	.40**	9.64**	0.47**	.43**	11.71**
Female	9.00**	.11**	2.62**	8.23**	.10**	2.78**
Age	-7.88**	-.12**	-2.89**	-1.8	-.03	-0.77
Days Absent	-5.11**	-.14**	-3.27**	-5.15**	-.14**	-3.83**
Quartile						
TDHS	12.75**	.15**	3.69**	10.26**	.13**	3.44**

	R-Square (Adjusted)	Standard Error Estimate	Degrees of Freedom	Effect Size
Math – to May	.334	33.07	372	.18
Math – to Feb	.261	39.17	434	-.15
Read – to May	.251	36.30	456	.32
Read – to Feb	.249	35.30	582	.26

Table 3
Achievement Gains TDHS vs. Control

	8th to May Gains			8th to Feb Gains			Feb to May Gains		
	Coef.	**Beta**	**t***	**Coef.**	**Beta**	**t***	**Coef.**	**Beta**	**t***
MATH									
Intercept	368.26**		6.84**	357.45**		6.40**	329.13**		6.76**
Prior	-0.50**	-.51**	-11.67**	-0.51**	-.48**	-11.49**	-0.39**	-.51**	-10.57**
Female	-13.72**	-.17**	-3.97**	-11.17**	-.13**	-3.07**	-0.23	.00	-0.07
Age	-1.07	-.02	-0.37	-0.01	.00	0.02	-0.53	-.02	-0.35
Days Absent	-3.17*	-.09*	-2.02*	-5.62**	-.14**	-3.40**	-4.40	-.08	-1.60
Quartile									
TDHS	7.85*	.09*	1.95*	-3.06	-.03	0.72	8.90**	.11**	2.31**
READING									
Intercept	502.18**		10.31**	401.54**		8.87**	399.67**		9.41**
Prior	-0.54**	-.50**	-12.26**	-0.53**	-.48**	-12.87**	-0.44**	-.53**	-12.08**
Female	4.40	.05	1.35	7.06*	.09*	2.33*	6.25*	.09*	2.17*
Age	-9.53**	-.15**	-3.68**	-3.41	-.05	-1.42	-7.67**	-.15**	-3.38**
Days Absent	-0.56	-.02	-0.38	-2.85*	-.08*	-2.06*	-0.71	-.02	-0.54
Quartile									
TDHS	12.42**	0.15**	3.78**	5.30	-.06	1.74	13.20**	.20**	4.55**

Table 3 (continued)

	R-Square (Adjusted)	Standard Error Estimate	Degrees of Freedom	Effect Size
Math – 8th to May	.307	33.03	372	.19
Math – 8th to Feb	.258	37.55	434	-.06
Math – Feb to May	.280	29.46	327	.23
Reading – 8th to May	.279	34.49	456	.28
Reading – 8th to Feb	.230	36.23	583	.13
Reading – Feb to May	.291	28.45	404	.43

Table 4
TDHS Advantage

	MATH			READING		
	TDHS	**Control**	**Difference**	**TDHS**	**Control**	**Difference**
Scale Score – 8th Grade	625	631	-6	625	626	-1
Scale Score – May	660	655	+5	655	644	+11
Gain	+35	+24	+11	+30	+18	+12
Grade Equiv. – 8th Grade	5.1	5.4	-0.3	4.3	4.4	-0.1
Grade Equiv. – May	6.6	6.4	+0.2	6.3	5.7	+0.6
Gain	+1.5	+1.0	+0.5	+2.0	+1.3	+0.7
National % – 8th Grade	17.7	19.8	-2.1	20.9	21.3	-0.4
National % – May	27.6	22.8	+4.8	31.3	25.7	+5.6
Gain	+9.9	+3.0	+6.9	+10.4	+4.4	+6.0

Table 5
Percentage of Students Gaining 10 or more Percentiles
by Prior Achievement Level

	MATH				READING			
NP Range In 8th Grade	**TDHS (140)**	**Control (233)**	**P-value**	**% Students in Category**	**TDHS (257)**	**Control (200)**	**P-value**	**% Students in Category**
0-14.9	40%	27%	0.078	51%	47%	37%	0.138	48%
15-24.9	30%	16%	0.215	18%	36%	40%	0.764	20%
25-39.9	44%	17%	0.017*	19%	44%	39%	0.732	13%
40-49.9	67%	43%	0.375	4%	47%	24%	0.109	10%
50-99.9	33%	13%	0.281	8%	53%	15%	0.013*	9%
Total	41%	22%	0.000**		45%	35%	0.026*	

Maryland Functional Mathematics Test and Algebra 1 Pass Rates

Throughout the field test, district officials, principals, department heads, and a few teachers expressed unease that a focus on implementing the TDHS instructional program might lead to lower scores on the state functional reading, writing, and mathematics tests. Efforts were undertaken to build some test preparation into the course in a manner that would minimize time away from the courses. Many department chairs, however, felt this was not sufficient. The TDHS schools, however, performed comparably to the control schools on the functional reading, writing, and mathematics tests. Table 6, for example, shows that the TDHS schools had roughly equivalent value-added gains with regard to the Maryland functional mathematics tests compared to the control

schools and higher Algebra 1 pass rates. Higher Algebra 1 pass rates in the TDHS schools, in turn, might in part have resulted from the TDHS schools taking less time from classroom instruction for test prep.

Table 6
Maryland Functional Mathematics Test (MFT) and Algebra 1 Pass Rates

School	MD Func. Math Test-Overall Pass Rate	Change in HS Value Added to MFT Pass Rate 1999 to 2000	Algebra 1 Pass Rate
TDHS 1	77%	+20	71%
TDHS 2	41%	+ 7	64%
Control 1	48%	+ 7	55%
Control 2	62%	+15	52%

Student and Teacher Survey Results

During the 1999-2000 school year, students who received a double-dose of math and English instruction in both the TDHS and control schools were surveyed about their first semester catch-up courses. Students receiving the double-dose in the control schools took more traditional remedial courses. Compared to those in the control schools, a higher percentage of students in the TDHS schools stated that they were learning new skills, strategies, and concepts and that this helped them read better and understand math better. This can be seen in Table 7.

Table 7
Student Views on First-Term Catch-Up Courses in TDHS and Control Schools

In this class, did you feel that you were	TDHS	Control School 1	Control School 2
Learning new concepts and strategies in			
—Math	69%	59%	50%
—Reading	62%	41%	
Reviewing what you already know in			
—Math	31%	40%	50%
—Reading	35%	56%	
Percent of Students Who Agree	**TDHS**	**Control School 1**	**Control School 2**
Because of this class I read better	60%	45%	
Because of this class I understand math better	75%	53%	45%

Despite the inevitable implementation glitches of the first year, teachers gave high ratings to the initiative. All of the teachers attempting to implement the TDHS ninth grade instructional programs completed short surveys in February. Overall, as seen in Table 8, they found the teacher and student materials, workshop trainings, and in-class assistance to be of good quality.

Table 8
Teacher Views on Materials, Workshops, and In-Class Assistance

Percent of Teachers Who Rated the Following as Good Quality	Strategic Reading (N=9)	Transition to Advanced Math (N=10)
Teacher Materials	89%	100%
Student Materials	100%	100%
Workshop Training	56%*	100%
In-class Assistance	89%	90%

* 11% did not attend any training and thus did not answer.

Table 9
Teacher Use of Active Teaching Strategies

Compared to other classes you have taught, did the materials and support given better enable you to:	Strategic Reading (N=9)	Transition to Advanced Math (N=10)
—Use a more varied set of activities during the extended period	Yes-89%	Yes-100%
—Use cooperative learning strategies	Yes-78%	Yes-100%
—Use group projects	Yes-67%	Yes-100%
—Have students present multiple solutions or methods (or use multiple strategies to construct meaning from their texts)	Yes-89%	Yes-90%,
—Relate math concepts (or reading) to real world examples or experience	Yes-89%	Yes-100%

More significantly, the teachers indicated that the combination of materials, training, and in-class support enabled them to teach in a more effective manner. They noted, as seen in Table 9, that compared to other classes they had taught, they were able to use a more varied set of activities during extended periods, use cooperative learning strategies, engage students in group projects, and have students present multiple solutions or methods, and relate their academic work to real world experiences and examples.

Finally, the majority of teachers believed that students learned more from the TDHS reading and mathematics courses than they would have if the teachers had used a more traditional approach. This is seen in Table 10.

Table 10
Teacher Views on Did Students Learn More than They Would Have Using a More Traditional Remedial Approach?

	Yes	Somewhat	No
Strategic Reading (N=9)	66%	33%	0%
Transition to Advanced Math (N=10)	60%	40%	0%

Overall, the Baltimore study strongly supports the efficacy of the TDHS ninth grade instructional programs in reading/English and mathematics. Students in the experimental schools, despite significant implementation hurdles and challenges, had substantially more achievement growth than students in matched control controls. The size of the achievement gains was educationally significant. In addition to gains on standardized tests, students in the experimental

schools passed Algebra 1 at a higher rate, and performed just as well on the state's functional math, reading, and writing exams as students in the control schools who spent more time on test preparation. Students who took the TDHS courses found them more appropriate and efficacious than students who took more traditional remedial courses in the control schools. Teachers reported that the core elements of the TDHS instructional programs—research based curriculums, ongoing professional development, and in-classroom peer support—enabled them to teach in a more effective manner.

During the 2000-01 school year, two supplemental studies were undertaken to confirm the findings of the Baltimore study and address questions that could not be directly addressed by it.

Supplemental Study 1

During the 2000-01 school year, three high-poverty, non-selective Philadelphia high schools participated in a second field test of the TDHS ninth grade instructional program. All first-time ninth graders in each school took Strategic Reading and Transition to Advanced Mathematics during the first semester, and the school district's Algebra 1 and English 1 courses during the second term. Their achievement gains were compared to students in three matched control schools with similar demographics, as well as prior achievement and attendance levels. Students in both the experimental and control schools took the abbreviated version of the Stanford-9 achievement test in mathematics and reading in May. Results were compared to the students' scores on the eighth grade version of the exam administered in April of 2000 as part of the school district's accountability system. Thus, an advantage of the Philadelphia study is that it directly measured achievement growth from spring of eighth grade to spring of ninth grade. A disadvantage is that students in the control schools did not receive a double dose of math or English instruction.

As in Baltimore, teachers in the TDHS schools in Philadelphia received weekly in-classroom implementation assistance from curriculum coaches. Unlike Baltimore, however, teachers did not receive monthly professional development workshops that previewed upcoming units (the schools could not afford to pay the teacher stipends). Overall, a moderate level of math implementation was reported by the curriculum coaches for all three schools (within each school, there was a range from low to high implementation). In reading, the curriculum coaches reported high implementation in one school, medium in a second, and low in a third.

Overall, the Philadelphia study replicated the main findings of the Baltimore study. Students in the TDHS schools significantly outperformed students from the control schools on the Stanford-9 achievement test in both mathematics and reading. As seen in Table 11, the significance of the TDHS instructional program on scale score gains remained after controls for atten-

dance, gender, and age were added to the OLS regression equations. Effect sizes of .26 and .52 were obtained for reading and mathematics scale scores, respectively, and at all levels of prior achievement, a higher percentage of students in the TDHS schools registered achievement gains.

Students in the TDHS schools in Philadelphia did not appear to close achievement gaps in reading and mathematics to the same degree as the students in the Baltimore study. In mathematics, the average THDS student in Philadelphia moved from the 24th to the 26th percentile. Although not large, the gain stands in positive contrast to the average students in the control schools who lost 8 percentiles and moved from the 25th to the 17th percentile. In addition, 39% of the students in the TDHS schools gained 5 or more percentiles compared to 21% of the students in the control schools. In reading, the average TDHS student lost 7 scale score points compared to a 17-point decline for students in the control schools.

There are several possible explanations for this finding. In Philadelphia, the students' eighth grade test scores carried high stakes for their middle school. It was the key measure used in the district's accountability system. By 2000, Philadelphia middle schools had developed extensive test preparation efforts and had several years of experience optimizing test-taking conditions. In contrast, the administration of the Stanford-9 in ninth grade came with no stakes for the school or the student. In addition, unlike in the Baltimore study, students in the ninth grade in Philadelphia were not provided a small incentive to try their best to complete the test. It is also possible that the Stanford-9 was a more trying test than the CTBS-5 and, as a result, more students became frustrated and gave up. Some evidence of this can be seen in the fact that in one of the Philadelphia schools, 100 more students scored from 0 to the 5th percentile in ninth grade than in eighth grade. One challenge that remains unresolved when testing students who may be four or more grade levels behind is the question of what level of testing instrument should be used. Students whose true reading level is at the fourth grade fall close to the chance level on standardized tests normed for ninth graders. As a result, even a small difference in effort between the pre- and post-tests may cause these students to fluctuate from above to below the chance level (where they essentially earn a score of zero).

Table 11
Achievement Gains in Philadelphia TDHS vs. Controls

	8th to May		
	Coefficient	**Beta**	**T***
MATH			
Intercept	363.23**		19.91**
Prior	0.44**	.41**	15.86**
Female	5.06**	.10**	4.00**
Age	-1.00	-.03	-1.24
Attendance Rate	4.83**	.12**	4.48**
TDHS	11.75**	.21**	8.09**
READING			
Intercept	189.78**		10.19**
Prior	0.68**	.57**	24.17**
Female	4.90*	.06*	2.59*
Age	1.97	.04	1.77
Attendance Rate	5.54**	.08**	4.29**
TDHS	9.20**	.10**	4.29**

	R-Square (Adjusted)	**Standard Error Estimate**	**Degrees of Freedom**	**Effect Size**
Math	.231	21.30	1142	.52
Reading	.359	31.97	1169	.26

Supplemental Study 2

To measure the direct impact of the first-term catch-up courses—Strategic Reading and Transition to Advanced Mathematics—and to examine if positive impacts could be observed in multiple schools in multiple cities, students in all schools implementing the TDHS ninth grade instructional program during the 2000-01 school year were given pretests in September and posttests in January. For mathematics, the CTBS-5 was used, for reading the Gates-McGinitie. Overall, students in eight high schools across three cities (Philadelphia, Baltimore, and Newark) were tested in mathematics, and students in eight high schools across four cities (Philadelphia, Baltimore, Newark, and New York City) were tested in reading. Table 12 shows that average performance at the school level ranged from gains of 1.3 years to 5 months in mathematics over a four-month period across the eight schools, and that across all schools, the average outcome was a gain of eight months over four months. Table 13 shows that, in the average school, more than half the students gained five or more months in reading ability over a four-month period, and that a third of the students gained a year or more in reading ability over four months.

Table 12
TDHS CTBS-5 Mathematics Achievement Gains Sept. to Jan. 2000-01

School	Mid-Sept. Pre-Test (Mean Grade Equivalent)	Mid-Jan. Post-Test (Mean Grade Equivalent)	Gain (Years/months)
Baltimore TDHS 1	5.9	7.2	1.3 years
Baltimore TDHS 2	5.3	6.0	7 months
Baltimore TDHS 3	5.5	6.1	6 months
Newark TDHS 1	6.0	7.0	1.0 year
Newark TDHS 2	5.5	6.1	6 months
Philadelphia TDHS 1	5.3	6.3	1.0 year
Philadelphia TDHS 2	5.7	6.5	8 months
Philadelphia TDHS 3	6.6	7.1	5 months
Average Gain for all TDHS over a 4-Month Period			**8.1 months**

These results indicate that both the Strategic Reading and Transition to Advanced Mathematics courses help students close their achievement gaps. In four of eight high schools, for example, the typical student learned at twice the normal rate in mathematics. In five of nine high schools, a third or more of the students gained two and half times as much as the average student nationwide in reading skill.

In the three Philadelphia schools, at least half of the students demonstrated catch-up gains on the CTBS mathematics test and Gates McGinitie reading test (gaining more than four months over a four-month period). This stands in contrast to the more limited or lack of catch-up gains demonstrated on the Stanford-9.

Table 13
TDHS Ninth Grade Reading Gains Sept-Jan. 2000-01*

School	Number who took Pre- and Posttest	% with Catch-Up Gains (5 months or more)	% Gaining a Year or More in Reading
Baltimore TDHS 1**	64	71%	55%
Baltimore TDHS 2	231	44%	28%
Baltimore TDHS 3	112	44%	29%
Philadelphia TDHS 1	191	58%	47%
Philadelphia TDHS 2	59	53%	29%
Philadelphia TDHS 3	206	46%	34%
Newark TDHS 1	172	54%	33%
NYC TDHS 1	331	50%	34%
Average Gain for all TDHS	**1366**	**51%**	**35%**

* Median September Reading Level was 5.0 to 5.6 grade equivalents in all schools except NYC at 6.8
** Two highest-implementing teachers

DISCUSSION AND CONCLUSION

Several clear conclusions emerge from this analysis of the TDHS ninth grade instructional interventions in mathematics and reading.

- In both Baltimore and Philadelphia, students in the TDHS schools significantly outperformed students in the control schools in mathematics and reading achievement gains, controlling for their prior achievement, attendance, age, and gender.
- This achievement advantage occurred at all levels of prior achievement. Students at both the low and high ends of the prior achievement spectrum appear to have benefited by their participation in the TDHS ninth grade instructional interventions in math and reading. This is potentially highly significant because, if confirmed, it indicates that almost all students who enter high-poverty high schools could benefit from initial instruction specifically designed to improve their reading comprehension and mathematical reasoning abilities, while at the same time filling in skill gaps they may have.
- There are strong, though not unequivocal, indications that curricular and instructional interventions can be designed, which will substantially accelerate adolescent learning. This can be seen most clearly in the analysis of mathematics achievement growth in Baltimore and Philadelphia. In both locales, significant numbers of students, though not majorities, who entered ninth grade testing at the sixth grade level gained 10 or more percentile points, placing them on trajectories to reach the 50th percentile or grade level by the end of high school.
- These gains occurred despite less-than-perfect implementation and in the face of considerable implementation challenges. This indicates that the instructional interventions are robust and can have impact when conditions are less than ideal. This is important because the often chaotic nature of high-poverty high schools is a reality that is not easily tempered. At the same time, the results hint that greater gains might occur with stronger implementation. In each school, one teacher typically got consistently large gains across his or her class. Finally, it should be noted that the results obtained occurred amid substantial implementation support, particularly the availability of non-evaluatory in-classroom implementation support by skilled curriculum coaches. Although the significance of this support to the found outcomes cannot be easily gauged, it is clear from the facilitators' reports that implementation levels would have been considerably lower and, in many cases, implementation would not have occurred without their presence.
- An important finding from the main Baltimore study is that the majority of students and nearly all the teachers reported liking the courses and viewing them as positive and successful interventions. This is critical because without active student participation and committed teachers the reading and mathematics interventions cannot succeed.

The results also speak to a number of unanswered questions and areas in need of further research. First, while the typical students appear to have benefited from the reading and mathematics interventions and a substantial number of students had large gains, a subset of students did not appear to improve their reading and mathematics skills. More research is needed into why some students are not benefiting, and what additional interventions likely need to be designed for some of these students.

Second, it is also clear that while a large number of students made substantial in-roads into closing their achievement gaps, a one-semester intervention is not sufficient to close three- and four-year gaps. The Talent Development High School model is field-testing 10th and 11th grade first semester interventions in math and reading. Until the initial evaluations of these programs are complete, the degree to which multi-year achievement gaps can be closed over the high school years will remain unknown.

Finally, there is a clear need to develop appropriate measures and strategies for testing high school students who are multiple years below grade level and attend schools with low attendance rates. Means of accurately gauging the achievement growth of students who are near the chance level for tests normed for their grade level need to be refined, as do ways of consistently motivating students to take the tests seriously and not become frustrated and give up. It will be difficult to develop a knowledge base on accelerating adolescent learning and accurately evaluate different approaches and interventions until common testing protocols and appropriate instruments and measurement strategies are devised.

Given these unanswered measurement questions, these results need to be seen as formative. While each of the studies has its methodological limits, taken together, they provide a strong indication that the TDHS ninth grade instructional interventions in mathematics and reading had positive and significant impacts in high-poverty high schools in multiple cities. As such, they can be seen as an initial confirmation in a much wider set of schools and conditions of the positive impacts of adolescent literacy courses based on current research, and as a demonstration that similar impacts can be achieved in mathematics. The full extent of the impact of ninth grade instructional interventions in reading and mathematics, the speed with which students can catch up, and the extent to which different levels of implementation impact both outcomes await further detailed summative evaluations. In the meantime, the initial results are of sufficient magnitude to encourage other efforts to design instructional interventions that will allow all students, regardless of their level of preparation, to succeed in challenging, standards based, high school coursework.

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