JOURNAL OF EDUCATION FOR STUDENTS PLACED AT RISK, *11*(2), 143–159

Closing the Mathematics Achievement Gap in High-Poverty Middle Schools: Enablers and Constraints

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The mathematics achievement levels of U.S. students fall far behind those of other developed nations; within the United States itself, the students who are falling behind come predominantly from high-poverty and high-minority areas. This article reports on a series of analyses that followed 4 cohorts of students from 3 such schools through the 5th to 8th grades, where studies have found the mathematics achievement gap to develop most rapidly. The cohorts followed in these analyses attended schools implementing whole-school reform models that incorporated research-based, proven curricula, subject-specific teacher training and professional development, multiple layers of teacher and classroom support, and school climate reforms. The research found that students at schools implementing the whole-school reform (WSR) models made greater progress in closing the mathematics achievement gap than at the other 23 high-poverty, high-minority schools in their district. Using the results from a Binary Logistic Regression model, we show which factors were key in enabling or constraining a student's ability to close the achievement gap during the middle school years. We conclude that various student-, classroom-, and school-level factors are all key in helping students to close the gap. WSR models, while often time- and cost-intensive, address issues at all of these levels and may be more able to affect the achievement gap than other, more simply implemented reforms.

For many high-poverty students, the middle grades are a period in which achievement gaps in mathematics become achievement chasms. Nearly all high-poverty students enter kindergarten with the most basic mathematical knowledge at hand;

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they can count and recognize basic shapes (West, Denton, & Reaney, 2000). However, many students end middle school ill-prepared to succeed in a rigorous sequence of college-preparatory mathematics courses in high school (Balfanz, McPartland, & Shaw, 2002). National and international comparisons of student achievement indicate that it is between fourth and eighth grade when U.S. students in general, and minority and high-poverty students in particular, fall rapidly behind desired levels of achievement (Beaton et al., 1996; Schmidt et al., 1999). In nearly all of the nation's states there is a 30 to 50 percentage-point difference between White students and the largest minority group in the percentage of students scoring at the basic level on the eighth-grade National Assessment of Educational Progress (NAEP) exam (Blank & Langesen, 1999). For the high concentrations of minority students attending high-poverty urban schools, as well as for the nation as a whole, low mathematical proficiency at the end of the eighth grade has serious consequences. The ability to succeed in college-preparatory mathematics courses in high school has been linked to success in postsecondary schooling and to lifelong opportunities for success (Pelavin & Kane, 1990; U.S. Department of Education, 1997). In addition, large concentrations of poor and minority students receiving weak academic preparations in their middle school years help to create in our nation's largest cities neighborhood high schools that function as little more than dropout factories rather than as stepping-stones to a strong education and upward mobility (Balfanz & Legters, 2001).

Many explanations have been offered for the middle-grades mathematics achievement gap. Plausible causes of the gap, based on credible, if not always comprehensive or incontrovertible, evidence, are weak and unfocused curricula (Schmidt et al., 1999); shortages of skilled, trained, and knowledgeable mathematics teachers (National Commission on Mathematics and Science Teaching for the 21st Century, 2000); unequal opportunities to learn challenging mathematics (Raudenbush, Fotiu, & Cheong, 1998); undermotivated students (Bishop & Mane, 2001); and the turbulence of early adolescence. Each has also brought its own set of reforms. The last decade has seen the advent of more challenging learning standards and higher stakes accountability systems for schools and students, the movement toward smaller learning communities in large middle schools, the conversion of middle schools into K–8s (in an effort to create more personalized learning environments), the spread of research-based mathematics curricula, and attempts to develop and maintain a stronger corps of middle-grades mathematics teachers (Burrill, 1998). However, although there has been an overall upward trend in elementary and, to some extent, middle-school mathematics achievement during this period, as well as some notable success in high-poverty schools, there has been no dramatic and widespread shrinking of the middle-grades mathematics achievement gap between more and less advantaged students (Lee, 2002).

One possible explanation for this is that the relatively easy and inexpensive legislative reforms, which primarily affect the context of learning-increased graduation requirements, higher stakes testing, and district or statewide standards, have been enacted with some force in the high-poverty middle schools that many minority students attend. The more expensive and difficult reforms, however, which directly impact classroom practice—strong instructional programs, better supported, trained, and more knowledgeable mathematics teachers, and improved learning climates—have not been implemented successfully on a broad scale in high-poverty, high-minority middle schools (Balfanz, Ruby, & MacIver, 2002). Thus, while the push for higher levels of achievement may have increased, the tools needed to make it happen on a broad scale in high-poverty middle schools may not have followed in sufficient scope and magnitude.

A second possible explanation is that we do not know enough about the origins and contours of the middle-grades mathematics achievement gap, particularly among poor and minority students who enter middle school behind grade level, to develop sufficiently targeted interventions. Simply put, few large-scale data sets exist or have been developed that enable poor and minority students to be followed longitudinally over the middle grades at the classroom level, where teaching and learning occur. Consequently, nearly all of our theories and explanations of the achievement gap are based on correlations, cross-sections, and/or national- or state-level comparisons many levels removed from classroom teaching and learning. As a result, many of our insights are based on mean or average levels of group performance rather than on close analysis of individual- or classroom-level achievement growth patterns over the middle grades, which would allow a closer examination of the factors that enable and constrain the closing of the mathematics achievement gap.

This article presents evidence to support both possibilities. It examines gains in mathematical achievement of multiple cohorts of high-poverty middle-grades students between the fourth and eighth grades in the school district of Philadelphia over the past 6 years. We found that the first three schools in the district to implement a comprehensive set of instructional, teacher support, and school climate reforms (embedded in the Talent Development Middle Schools [TDMS] reform model) had significantly greater numbers of students close their mathematics achievement gaps than did the other 23 middle schools in the district also serving high-poverty and high-minority student bodies. We also found strong bimodal tendencies in the achievement growth patterns of high-poverty middle-grades students who enter middle school behind grade level. Across all the high-poverty middle schools in the district, a significant number of students who entered middle school behind grade level left eighth grade much closer to grade level and, in some cases, at or above it. For these students, something about their middle-grades mathematics experience worked. The majority of students who attended high-poverty middle schools, however, left eighth grade often considerably further behind grade level than when they entered middle school.

The finding that significant numbers of high-poverty students closed their mathematics achievement gaps during middle school shows that closing the gap can be done and alerts us to the need to search for the factors that enable it. The fact that most students did not close their gaps simultaneously signals the need to better understand the factors that constrain achievement growth in the middle grades. The remainder of this article reports on our initial findings.

DATA AND METHODS

To better understand what affects students' progress in closing achievement gaps during the middle school years in large, urban, high-poverty, minority-dominated schools, we have looked at a wealth of data collected in the Philadelphia School District over a 6-year time period. In this article, we further focus our analysis on three middle schools—Central East Middle School (CEMS), Cooke, and Beeber—which were demographically representative of the district's other high-poverty, high-minority schools, but which were also implementing a comprehensive whole-school reform model (TDMS) during the time period under study. This enables us to examine the impact of comprehensive reform and the factors that enable and constrain mathematics achievement gains in the middle grades of schools implementing many of the reforms proposed to close minority achievement gaps (strong instructional programs, increased teacher support and training, and enhanced school learning climates).

Demographic and school data from the 1996 to 1997 school year, presented in Table 1, show that the majority of students in these three schools are minority students from low-income families, and that the schools suffer from high student turnover and extremely large class sizes. This emphasizes the difficult settings in which education occurs for these students who enter middle school already far be-

TABLE 1
School Demographics

	Central East Middle School %	*Cooke %*	*Beeber %*
Demographic Characteristic			
White	13	1	1.0
Black	28	77	98.5
Hispanic	47	9	0.5
Asian	12	13	0
Student attendance rate	90	87	90
Low-income families	86	87	71
8th graders in school previous year	76	68	85
Percent of classes with 30 or more students	79	62	100
Teacher attendance rate	93	93	94
Mean state percentile 5th-grade PSSA	16.6	13.6	N/A
Mean state percentile 8th-grade PSSA	19.4	16.3	23.7

Note. PSSA = Pennsylvania System of School Assessment.

hind state and national averages (13th–15th percentile on the fifth-grade Pennsylvania System of School Assessment [PSSA] state achievement test).

Students were included in the analyses if we had data for their pretest, posttest (on the Stanford-9 Achievement Test; SAT-9), gender, race, school, cohort, effort (survey response), behavior, and attendance. Under these constraints, data were available for a total of 1,233 students from four cohorts at the three schools (see Appendix, Tables A1 and A2 for Sample Characteristics). From the sample data, we also see that students for whom we had all the necessary data had slightly higher attendance rates than the school averages; this was not a surprise, as the more data present for the student, the more likely it was that he or she was at school on a regular basis and his or her data was recorded. The data used in this study were provided by the Philadelphia City School District and supplemented by additional testing and surveying done by the Talent Development program.

The first cohort began fifth grade in 1996–1997, the second in 1997–1998, the third in 1998–1999, and the fourth in 1999–2000. These students finished eighth grade in 1999–2000, 2000–2001, 2001–2002, and 2002–2003, respectively. Due to testing limitations, the cohorts were not measured through all of middle school but by various lengths of time depending on the cohort and the middle school. Cohorts 2, 3, and 4 were measured through Grades 5–7 in CEMS and Cooke, and only Grades 6–7 in Beeber. Cohort 1 was measured through Grades 5–8 in CEMS, Grades 6–8 in Cooke, and not at all in Beeber. While most Cohorts were first tested (pretest) in the spring, Cohorts 2, 3, and 4 in Beeber and Cohort 1 in Cooke were all pretested in the fall.

Logistic Regression Analysis was conducted to determine the impact of certain enabling and constraining factors in whether or not students were able to close achievement gaps during their middle-school years. In the regression models that were run, the outcome measured was whether students were catching up during the middle-school years. This was determined by a dummy variable coded 1 if a student gained more Grade Equivalents (GEs) on the SAT-9 standardized test than time spent in school (i.e., if a student gained more than 3.0 GEs during a 3-year time span) and 0 if they gained fewer GEs than the time elapsed.

GE scores are an attractive measure for expressing the achievement gap as their values are easily recognized by parents and teachers. However, it should be noted that Normal Curve Equivalents (NCE) are the generally preferred measure for methodological reasons. NCEs have statistical properties that make them superior to GEs and percentiles for evaluating achievement gains over time and for averaging the achievement scores of groups of students. However, the outcome measure in our logistic models for whether or not students closed the achievement gap is a simple dummy variable, and only indirectly based on a gain-value derived from GEs.

The factors we were able to control for were students' average attendance rate over the time span, their average behavior marks in classes, their ethnicity, what cohort they were in, which of the three schools they attended, their effort in Math class (as determined by their responses to the question "How hard are you working in Math class?" on the Talent Development Student Survey, given a 1 to 7 response scale, 1 being *Not hard at all* and 7 being *As hard as I can*) and finally, what percentage of their homerooms during the time span were "High Gain Homerooms" (a homeroom in which the class average gain on the SAT-9 test was more than the time elapsed in terms of GEs, also a dummy variable). Students' gender was also available but was the only factor not to prove significant.

FINDINGS

High-Poverty Middle-Grades Mathematics Achievement Growth Appears to Follow a Bimodal Pattern

The most striking evidence from the study is the bimodal distribution of gains across the middle schools and cohorts. This can be seen in Table 2. Looking first at the average gain by each cohort within each school, we see that the average gain in terms of GEs is almost equal to, and in some cases greater than, the amount of time measured in middle school. This implies that the cohorts in each school are staying on course, gaining as much as is expected by national standards, and in some cases even surpassing them. However, when the gains are broken down by those who caught up and those who did not, we see that those 44% of students who caught up gained significantly more than expected while those who did not fell far behind national standards. We also see from Table 2 that in each school and cohort, both groups started off middle school below grade equivalency, so those who caught up over the time measured made great strides in getting back to national norms, while those who did not continued to fall even further behind before reaching high school.

We see a similar pattern when looking at the other 23 high-poverty, high-minority middle schools (80%+ minority, 80%+ low-income families) in the Philadelphia School District. As seen in Table 3, roughly one-fifth to a quarter of the students are gaining through the middle-school years while the others continue to fall further behind in terms of grade equivalencies.

This bimodal distribution is also triangulated and confirmed by looking at the results of the three TDMS and the district's other 23 high-poverty, high-minority middle schools on the state assessment, the PSSA, which is a standardized test administered statewide by the Pennsylvania Department of Education (see Table 4). The PSSA scores are not reported in terms of grade equivalencies, but by looking at state percentiles, another group-normed measure, we see that middle-school students are gaining on average 2 to 5 state percentiles but that there is a great distinction between two groups. Roughly a third to a quarter of students are gaining more than 20 state percentiles while the other two-thirds to three-quarters of the students are losing 2 to 3 percentiles and falling further behind the majority of the student population.

TABLE 2
Average Gains Over Middle School

School/Cohort	*Time in Terms of GE*	*Overall Gain*	*Catching Up*	*Catching Up %*	*Net Gain M*	*Pretest Behind GE*	*Posttest Behind GE*
Beeber 2 (F6-S7)	1.6	+1.1	No	68	+0.5	–0.7	–1.7
			Yes	32	+2.3	–2.2	–1.4
Beeber 3 (F6-S7)	1.6	+1.5	No	46	+0.5	–0.9	–2.0
			Yes	54	+2.4	–1.7	–0.8
Beeber 4 (F6-S7)	1.6	+2.1	No	26	+0.6	–1.0	–1.9
			Yes	74	+2.6	–1.9	–0.8
Cooke 1 (F6-S8)	2.6	+3.0	No	42	+1.9	–2.0	–2.6
			Yes	58	+3.8	–2.1	–0.8
Cooke 2 (S4-S7)	3.0	+2.8	No	68	+2.1	–1.4	–2.4
			Yes	32	+4.2	–1.1	+0.2
Cooke 3 (S4-S7)	3.0	+2.9	No	57	+2.1	–1.0	–2.0
			Yes	43	+4.0	–0.7	+0.3
Cooke 4 (S4-S7)	3.0	+3.2	No	60	+2.3	–1.2	–2.0
			Yes	40	+4.6	–0.5	+1.1
CEMS 1 (S4-S8)	4.0	+3.5	No	60	+2.5	–0.4	–2.0
			Yes	40	+5.1	–0.0	+1.2
CEMS 2 (S4-S7)	3.0	+2.5	No	67	+1.5	–0.0	–1.5
			Yes	33	+4.6	+0.3	+1.9
CEMS 3 (S4-S7)	3.0	+2.2	No	81	+1.5	–0.5	–2.0
			Yes	19	+5.2	+0.2	+2.4
CEMS 4 (S4-S7)	3.0	+2.8	No	65	+1.7	–0.3	–1.6
			Yes	35	+4.8	+0.6	+2.4

Note. CEMS = Central East Middle School; F = Fall test; GE = Grade Equivalent; S = Spring test.

TABLE 3
District Comparison: Other High-Poverty, High-Minority Middle School
(23 Schools, 11,868 Students)

Cohort	*Time in Terms of GE*	*Overall Gain*	*Catching Up*	*Catching Up %*	*Net Gain M*	*Pretest Behind GE*	*Posttest Behind GE*
Cohort 2 (S4–S7)	3.0	+2.1	No	81	+1.6	–0.9	–2.3
			Yes	19	+4.2	–0.9	+0.3
Cohort 3 (S4–S7)	3.0	+1.9	No	84	+1.6	–0.8	–2.2
			Yes	16	+4.0	–1.0	0.0
Cohort 4 (S4–S7)	3.0	+2.3	No	77	+1.8	–0.8	–2.0
			Yes	23	+4.2	–1.0	+0.2
All three cohorts	3.0	+2.1	No	81	+1.6	–0.8	–2.2
			Yes	19	+4.1	–1.0	+0.1
TDMS Companion	3.0	+2.5	No	72	+1.7	–0.7	–2.0
Group N = 1,830			Yes	28	+4.4	–0.4	+1.0

Note. GE = Grade Equivalent. TDMS = Talent Development Middle School.

TABLE 4
Pennsylvania System of School Assessment Gains: Cohorts 1, 2, and 3

Group	*Overall Gain*	*Gained 10 or More State Percentiles*	*Net Gain M*	*Pretest M*	*Posttest M*
TDMS (3 schools, 1,785 students)	+5.8	No (67%)	–2.0	18.6	17.1
		Yes (33%)	+21.3	20.9	37.4
Other school (23 schools, 11,220 students)	+2.6	No (76%)	–3.0	16.2	13.5
		Yes (24%)	+20.6	17.0	32.8

Note. TDMS = Talent Development Middle Schools.

A Higher Percentage of Students in TDMS Had "Catch-Up" Gains

From Tables 3 and 4, we can also see that the cohorts at TDMS appear to be doing better over the middle-school years than those students at the district's other high-minority, high-poverty middle schools. *T* tests confirm that the differences between the two groups of schools hold up as statistically significant. On the SAT-9 standardized test, the 27% of TDMS students catching up is significantly greater than the comparable 19% in the rest of the district at the $\alpha - .001$ level ($p = 0.000$, $t = 7.311$, $df = 13696$). For the state-administered PSSA exam, 33% of TDMS students gained more than 10 state percentiles, while only 24% of students in the district's other schools gained as much, a difference significant at the .001 level ($p = 0.000$, $t = 8.167$, $df = 13003$). For the 11 groups included in our regression analysis (four cohorts at two schools and three at a third school), we find an average of 42% of students catching up on the SAT-9, although we know the students in the analysis had a higher-than-average attendance rate. Figure 1 shows the percentage of students gaining more than 10 state percentiles on the PSSA for each of the district's 26 high-minority, high-poverty middle schools, the two oldest TDMS schools achieving the highest percentages in the entire district.

Factors Which Enable and Constrain Catching Up

When we break down the SAT-9 gains made by students who caught up and those who did not, we find that there is no immediately discernable pattern in their gains from year to year. Students who are catching up do not gain consistently each year, and neither group tends to gain more in early or later years in any consistent fashion (see Appendix, Table B).

Although puzzling at first, this seems less surprising when examining the results from the Logistic Regression Model. When we entered students' behavior marks, attendance rates, effort in math class, and the percentage of their homerooms that were

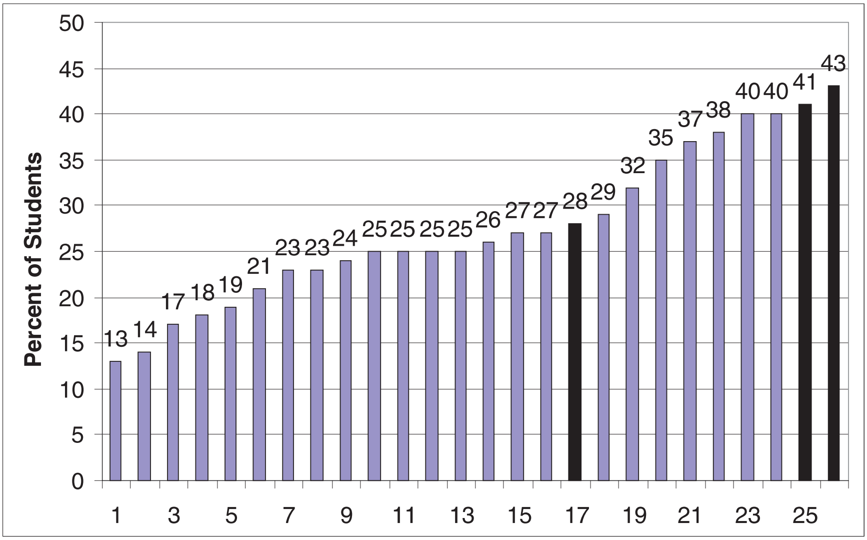

FIGURE 1 Percent of students gaining 10 or more state percentiles from fifth grade to eighth grade on the Math PSSA test in high-poverty, high-minority schools. *Note*. Data for 3 Cohorts—2000, 2001, and 2002—are averaged.

high-gain, no one single factor is far more predictive of catching up than another, but all are highly significant in affecting a student's odds of catching up during his or her middle school years (see Appendix, Table C). The variation between the different cohorts, the advantage of being placed in a highly effective homeroom one year (but maybe not the next), the effect of a student's attendance (susceptible to a student's health and family life), the student's effort in class, and his or her behavior in school, as well as the variation between all three schools, can all cause large swings in year-to-year gains for students who catch up and for those who do not.

To clarify the impact of each of these variables, we constructed graphs that show how changes in each of the variables impact a student's odds of catching up, holding the other factors steady at the sample averages.

High Gain Classrooms

For the percentage of high-gain homerooms that a student passed through (the percentage of his or her homerooms where the class averaged grade-equivalent gains of more than 1 year), there was a 37% difference in the probability of catching up between students who went through no high-gain homerooms and students for whom all their homerooms were high-gain. For the sample, 13% of students had 0% high-gain homerooms, 3% of students had 25%, 32% of students had 33%,

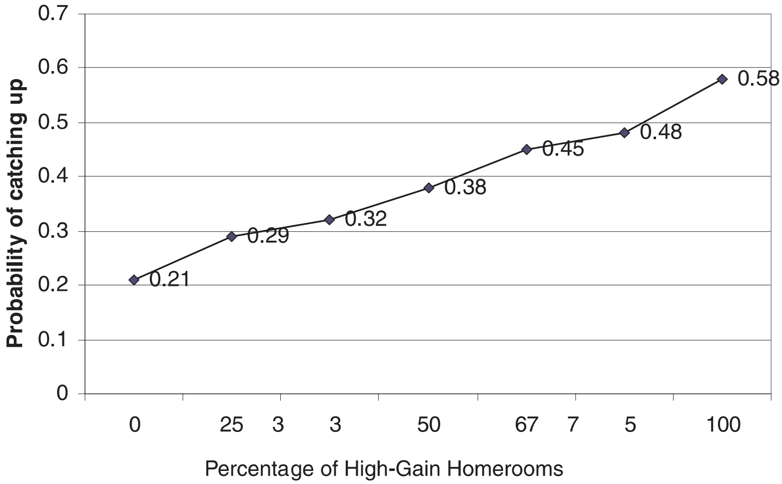

FIGURE 2 Impact of attending high-gain classrooms. (Calculated for most common/average student categories: CEMS student, Non-Asian Student, from Cohort 1, attendance rate of 92%, behavior of 2, effort of 6)

20% of students had 50%, 18% of students had 67%, and 14% of students had 100% (see Figure 2).

Attendance

There was a 20% difference in the probability of catching up for a student who had a 60% attendance rate versus a student who attended every day of school during the 3 to 4 years measured. In the sample, 47% of students had attendance rates of 95% or higher, 30% had attendance rates greater than or equal to 90% but less than 95%, 14% had attendance rates greater than or equal to 85% but less than 90%, and 9% of students had attendance rates lower than 85% (see Figure 3).

Effort

A student who said he or she was "working as hard as I can" in math class (responses of 7 on the scale) had a 19% greater probability of catching up than did students who said they were "not working hard at all" in math class (responses of 1 on the scale). Half of the sample (49% of students) said they were working toward the higher end of the scale (response averages higher than 6 on a scale of 1–7), while 41% responded in the middle of the scale (response averages less than or equal to 6 but greater than 4; the remaining 10% of students said they were working at the lower end of the scale (response averages of 4 or less; see Figure 4).

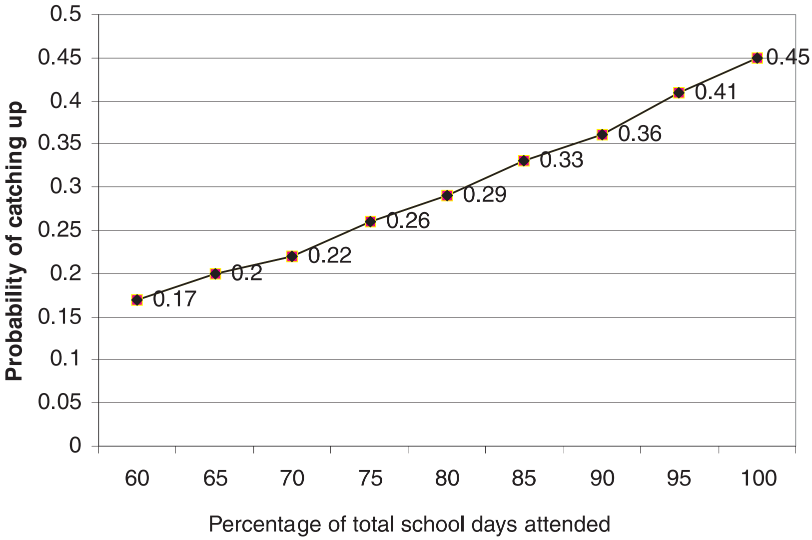

FIGURE 3 Impact of attendance (Calculated for most common/average student categories: CEMS student, Non-Asian Student, from Cohort 1, with effort of 6, behavior of 2, high-gain homerooms of 50%).

Behavior

There was a 22% difference in the probability of catching up for students who averaged behavior marks of excellent (score of 1) compared to those who averaged behavior marks of unsatisfactory (score of 3). Half of the sample (49%) averaged behavior marks near excellent while the other half (51%) had marks closer to satisfactory or unsatisfactory (see Figure 5).

DISCUSSION

The figures used to illustrate the logistic regression analysis vividly indicate that opportunity to learn and individual-level factors enable and constrain the closing of mathematics achievement gaps in high-poverty middle schools. The figures also show that there is no single magic bullet. No one factor alone significantly enables or constrains more than several others. Schools need to provide teachers and classrooms that enable the average student to gain more than a grade equivalent of mathematical skill and knowledge per year for multiple years. At the same time, students need to show up, behave in class, and try hard to learn. When these factors come together, achievement gaps close. Of the students from the sample who were in the high end for all of these categories (at least two-thirds of their homerooms

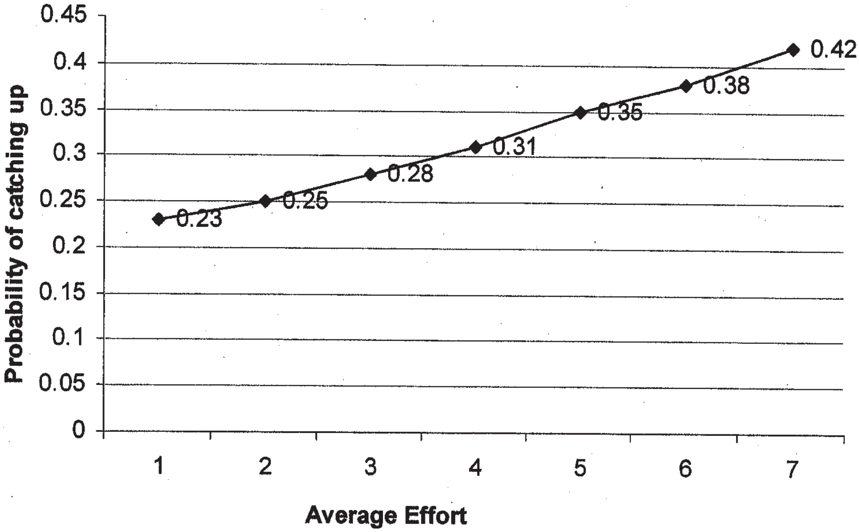

FIGURE 4 Impact of effort (Calculated for most common/average student categories: CEMS student, Non-Asian Student, from Cohort 1, with attendance rate of 92%, behavior of 2, high-gain homerooms of 50%).

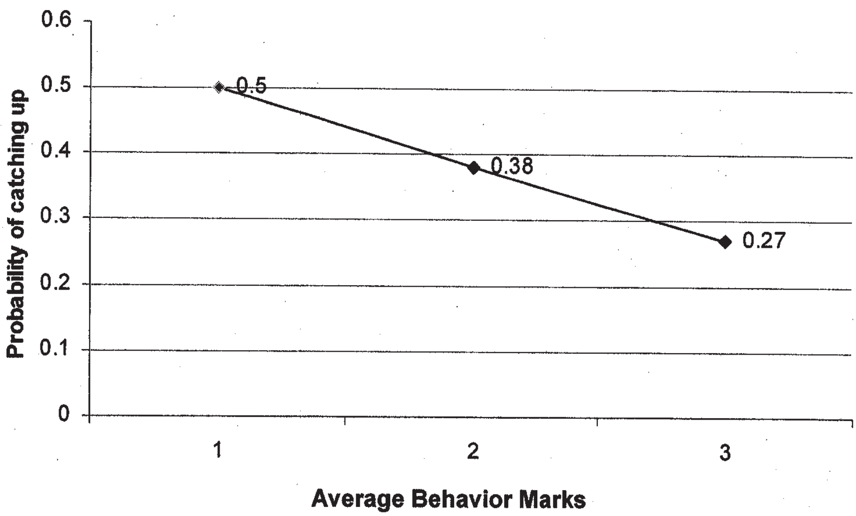

FIGURE 5 Impact of behavior (Calculated for most common/average student categories: CEMS student, Non-Asian Student, from Cohort 1, with attendance rate of 92%, effort of 6, high-gain homerooms of 50%).

were high-gain, they had attendance rates of 95% or higher, averaged behavior marks of around “Excellent,” and put forth greater effort in math class), a remarkable 77% were catching up during their middle-school years.

This highlights the importance of comprehensive whole-school reforms for high-poverty schools. A solitary focus on classroom, teacher, or student variables is not enough. It appears that all three have to be impacted simultaneously in a positive manner to create the teaching and learning conditions enabling students to close their mathematics achievement gaps and leave middle school ready to succeed in challenging high school courses. High-poverty schools need strong instructional programs and sustained and intensive teacher support to provide students with the opportunity to attend a high-gain classrooms every year. They need organizational reforms to create stronger student–teacher bonds and more caring and daring classroom environments that promote student effort and improve attendance. They need climate programs that reward positive behavior, have clear and consistent sanctions for negative behavior, and implement specific strategies to reduce and eventually eliminate out-of-control classrooms in which little or no learning can occur; and they need these elements to be implemented simultaneously and continuously.

At the same time, these findings signal the difficulty of strongly implementing and sustaining comprehensive and integrated whole-school reforms in high-poverty schools. Although significantly higher numbers of students made catch-up gains in the three TDMS compared to the other high-poverty, high-minority middle schools in the district, the odds of students consistently experiencing high-gain classrooms throughout middle school varied considerably from cohort to cohort within the Talent Development schools and for most students did not approach 75%.

Finally, these initial findings demonstrate the utility of following large numbers of high-poverty middle-grade students at the classroom level as they move through middle school and the existence of many unanswered questions remaining to be explored. For example, the factors that work to create high-gain classrooms need to be better understood, as do the factors that affect school climate and induce students to attend more often, work harder, and behave better in their classes.

CONCLUSION

High-poverty students who enter the middle grades below grade level in mathematics appear to follow one of two dramatically different paths through middle school. For a significant number of the students in the cohorts examined, something positive happened in middle school. An effective teaching and learning experience in middle-grade mathematics was achieved when students were exposed to one or more of the following: a string of good teachers and successful instructional experiences, a new-found self-confidence in mathematics, increased effort, and better attendance. They made large achievement gains, substantially closed their achievement gaps, and, in some cases, left eighth grade performing above grade level. For the majority of high-poverty students in the cohorts examined, however, middle-school math was not a successful experience. They entered the middle grades behind grade level and left even further behind, unprepared to succeed in challenging high school courses without substantial and sustained doses of extra help. For these students, individual actions—poor attendance, bad classroom behavior, and lack of effort—appear to have played a constraining role, but also relevant was the fact that they experienced few if any high-gain classrooms as they passed through middle school.

The longitudinal individual-level data set examined in this study provides some evidence to support both our hypotheses on why mathematics achievement gaps continue to exist between minority and majority, advantaged and disadvantaged students, despite wave after wave of reform efforts over the past 20 years. The three high-poverty middle schools implementing reforms that directly affected classroom practice—a strong schoolwide instructional program in mathematics, significantly increased teacher support and training (including in-classroom nonevaluator peer coaching), and organizational reforms to improve student–teacher interactions (looping, small learning communities, teacher teams)—produced significantly higher percentages of students who made catch-up gains. This suggests that these reforms had yet to reach the other 23 high-poverty, high-minority middle schools in the district. At the same time, the regression analysis—which included the percentage of high-gain classrooms a student experienced, attendance, behavior, and effort—left more unexplained than explained regarding the factors that enable and constrain the closing of achievement gaps. This leads us to believe that we still have much left to learn and understand about this process.

REFERENCES

Balfanz, R., & Legters, N. (2001, January). *How many central city high schools have a severe dropout problem, where are they located, and who attends them?* Paper presented at the Dropouts in America Conference, Achieve and Harvard Civil Rights Project, Cambridge, MA.

Balfanz, R., McPartland, J., & Shaw, A. (2002, April). *Reconceptualizing the extra help for high school students in a high standards era*. Paper presented at the Preparing America's Future: The High School Symposium, Washington, DC.

Balfanz, R., Ruby, A., & MacIver, D. (2002). Essential components and next steps for comprehensive whole school reform in high poverty middle schools. In S. Stringfield & D. Land (Eds.), *Educating at-risk students* (pp. 128–147). Chicago: National Society for the Study of Education.

Beaton, A. E., Mullis, I. V. S., Martin, M. O., Gonzalez, E. J., Kelly, D. L., & Smith, T.A. (1996). *Mathematics achievement in the middle school years*. Boston: TIMSS Study Center.

Bishop, J. H., & Mane, F. (2001). The impacts of minimum competency exam graduation requirements on college attendance and early labor market success of disadvantaged students. In G. Orfield & M. L. Kornhaber (Eds.), *Raising standards or raising barriers? Inequality and high-stakes testing in public education* (pp. 51–84). New York: The Century Foundation Press.

Blank, R., & Langesen, D. (1999). *State indicators of science and mathematics education: 1999*. Washington, DC: Council of Chief State School Officers.

Burrill, G. (1998). Changes in your classroom: From the past to the present to the future. *Mathematics Teaching in the Middle School, 4*, 184–190.

Lee, J. (2002). Racial and ethnic achievement gap trends: Reversing the progress toward equity. *Educational Researcher, 31*(1), 13–25.

National Commission on Mathematics and Science Teaching for the 21st Century. (2000). *Before it's too late: A report to the nation*. Washington, DC: U.S. Department of Education.

Pelavin, S., & Kane, M. (1990). *Changing the odds: Factors increasing access to college*. New York: College Entrance Examination Board.

Raudenbush, S., Fotiu, R., & Cheong, Y. (1998). Inequality of access to educational resources: A national report card for eighth grade math. *Educational Evaluation and Policy Analysis, 20*, 253–269.

Schmidt, W. H., McKnight, C. C., Jakwerth, P. M., Cogan, L. S., Raizen, S. A., Houang, R. T., et al. (1999). *Facing the consequences: Using TIMSS for a closer look at the United States mathematics and science education*. Dordrecht, Netherlands: Kluwer Academic Publishers.

U.S. Department of Education. (1997, October). *Mathematics equals opportunity*. Washington, DC: Author.

West, J., Denton, K., & Reaney, L. (2000). *The kindergarten year: Findings from the Early Childhood Longitudinal Study, Kindergarten Class of 1998–99*. Washington, DC: U.S. Department of Education.

APPENDIX

TABLE A1
Sample Statistics[a]

	M	*SD*
Average attendance rate	93%	0.06
Average behavior mark[b]	1.5	0.36
Average % of high-gain homerooms	48%	0.29
Average effort	5.9	1.19

[a]N = 1,233. [b]1 = excellent, 2 = satisfactory, 3 = unsatisfactory.

TABLE A2
Sample Statistics[a]

Variable	*% of Sample*
Central East Middle School	38
Cooke	28
Beeber	34
Cohort 1	26
Cohort 2	30
Cohort 3	18
Cohort 4	27
Asian	11
Hispanic	17
Black	68
White	4
Female	53
Catching up	44

[a]*N* = 1,233.

TABLE B
Year-By-Year Gains

School	*Cohort*	*Catching Up*	*Catching Up %*	*Average 5th-Grade Gain*	*Average 6th-Grade Gain*	*Average 7th-Grade Gain*	*Average 8th-Grade Gain*
Central East Middle School	1	No	60	+1.6	+1.6	+0.8	+1.1
		Yes	40	+1.2	+0.3	+0.7	+0.2
	2	No	67	+0.9	+2.2	+1.5	
		Yes	33	-0.3	+1.2	+0.6	
	3	No	81	+1.1	+1.1	+3.0	
		Yes	19	+0.3	+0.6	+0.7	
	4	No	65	+0.3	+1.9	+2.7	
		Yes	35	-0.1	+0.8	+1.0	
Cooke	1	No	42		+1.6	+0.6	+1.6
		Yes	58		+1.2	+0.5	+0.2
	2	No	68	+2.2	+0.8	+1.4	
		Yes	32	+1.3	+0.5	+0.4	
	3	No	57	+1.7	+1.0	+1.4	
		Yes	43	+0.9	+0.3	+0.8	
	4	No	60	+1.3	+1.4	+1.9	
		Yes	40	+0.6	+0.9	+0.7	
Beeber	2	No	68		+1.0	+1.3	
		Yes	32		+0.3	+0.3	
	3	No	46		+0.6	+1.8	
		Yes	54		-0.1	+0.6	
	4	No	26		+0.8	+1.8	
		Yes	74		-0.1	+0.7	

TABLE C
Logistic Regression Model Results

Model Attributes

R^2	*χ^2*	*Significance*	*Percentage of Concordant Cases*	*N*
0.138	183.105	0.000	65.8	1,233

Parameter Attributes

Variable	*Parameter Estimate*	*Significance*	*Odds-Ratio*
Attendance	3.415	0.004**	30.429
Behavior	–0.506	0.010**	.603
Asian	0.632	0.002**	1.881
Cohort 2	–0.858	0.000**	.424
Cohort 3	–0.601	0.004**	.548
Cohort 4	–0.467	0.020*	.627
Cooke	0.395	0.013*	1.485
Beeber	0.991	0.000**	2.694
Effort	0.149	0.007**	1.161
Percent of High-Gain Homerooms	1.640	0.000**	5.157
Constant	–4.333	0.000**	0.13

*Significant at the α – .05 level. **Significant at the α – .01 level.