



Seven Keys to College Readiness Update

Montgomery County Public Schools

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Focus on Key 5: Algebra 2 and College Readiness

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Mathematics plays an important role in postsecondary success. The abstract reasoning and problem-solving skills that students develop through their study of high school mathematics are among the essential competencies that all high school graduates need in order to be prepared for college, the workplace, and everyday decision making (National Commission on Mathematics and Science Teaching for the 21st Century, 2000).

Montgomery County Public Schools (MCPS) has identified completion of Algebra 2 with a C or higher by the end of Grade 11 as one of the keys to college readiness. Although attainment of this key does not guarantee or predetermine postsecondary success, high school students who successfully complete Algebra 2 are less likely to need remediation upon entry to college and more likely to enroll in college, remain in college, and earn a bachelor's degree (Fong, Huang, & Goel, 2008; Horn & Nuñez, 2000; Horn, Kojaku, & Carroll, 2001; Horowitz, 2005). Awareness of these correlations may influence the choices that students and parents must make about students' high school programs.

The purpose of this accountability update is to present some of the research and data that support decisions to encourage all high school students to complete Algebra 2 with a C or higher by the end of Grade 11. Results are reported for 33,788 students in the MCPS Classes of 2001 to 2004. College readiness and postsecondary outcomes for MCPS graduates are drawn from MCPS records and the National Student Clearinghouse, a research service that provides college enrollment and degree information (National Student Clearinghouse, 2009).

College Remediation

About 75 percent of colleges offer remedial mathematics courses for students who are unprepared for college-level mathematics. Incoming freshmen at those colleges are not allowed to enroll in credit-bearing mathematics courses unless they demonstrate that they have the knowledge and skills to succeed without remediation, or until they complete prerequisite remedial courses (Achieve, Inc., 2006; Business-Higher Education Forum, 2005). Nationally, about one third of high school graduates who enroll in college are required to take one or more

remedial mathematics courses (Strong American Schools, 2008). Among two of the fastest-growing college populations, African American and Hispanic students, mathematics remediation rates are about 40 percent (Pearson, 2009).

In Maryland, mathematics remediation rates of high school graduates increased steadily between 1998 and 2007 (Maryland Higher Education Commission, 2009). However, the increases in remediation rates were smaller for students who completed a college-preparatory (core) curriculum that included Algebra 2 or higher. Among students who had completed Algebra 2 or higher, mathematics remediation rates rose 9 percentage points, from 23 percent in 1998 to 32 percent in 2007. In contrast, among students who had not completed Algebra 2 or higher, mathematics remediation rates rose 13 percentage points, from 36 percent in 1998 to 49 percent in 2007.

For MCPS students in the Classes of 2001 to 2004 who completed Algebra 2 with a C or higher by the end of Grade 11, 31 percent were identified as likely to need mathematics remediation upon entry to college,¹ a rate about equal to the national average (Figure 1). Of students who did not complete Algebra 2 with a C or higher by the end of Grade 11, 89 percent were identified as likely to be required to take remedial mathematics courses upon entry to college.

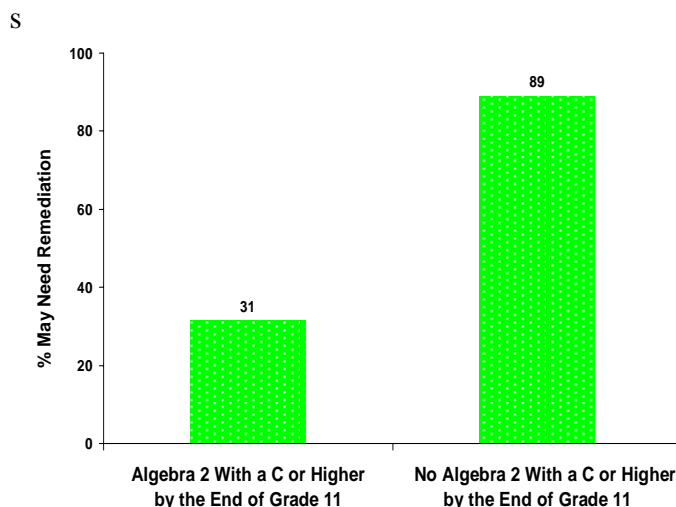


Figure 1. Percentage of graduates in the MCPS Classes of 2001 to 2004 who were likely to be required to take a remedial mathematics course upon entry to college by Algebra 2 status at the end of Grade 11.

¹ MCPS high school students who did not earn SAT math scores of 550 or higher were identified as potential candidates for mathematics remediation upon entry to college.

The consequences of inadequate high school mathematics preparation through the level of Algebra 2 or higher are expensive and time-consuming. Unprepared students must pay tuition for remedial courses but the credits earned are not applied toward a degree. Nationally, only about one third of students who are required to take remedial courses upon entry to college also remain in college and earn bachelor's degrees (Graves, 2008; Strong American Schools, 2008).

College Enrollment, Persistence, and Degree Attainment

Algebra 2 is a gateway to postsecondary success and one of the most powerful predictors of bachelor's degree attainment. The correlation exists in part because Algebra 2 is a prerequisite for many college courses, not only in mathematics and science, but also in social science, economics, business, and technology. Nationally, students who complete Algebra 2 in high school are more than twice as likely to graduate from college as students without this preparation (Achieve, Inc., 2006; Adelman, 1999, 2006). In MCPS, college degree attainment rates among students who completed Algebra 2 with a C or higher by the end of Grade 11 are more than three times those of students with lesser preparation (Figure 2).

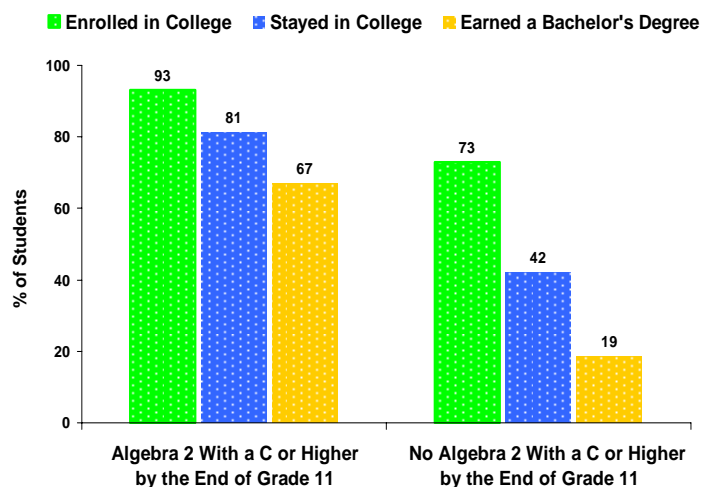


Figure 2. College enrollment, persistence, and degree attainment for graduates in the MCPS Classes of 2001 to 2004 by Algebra 2 status at the end of Grade 11.

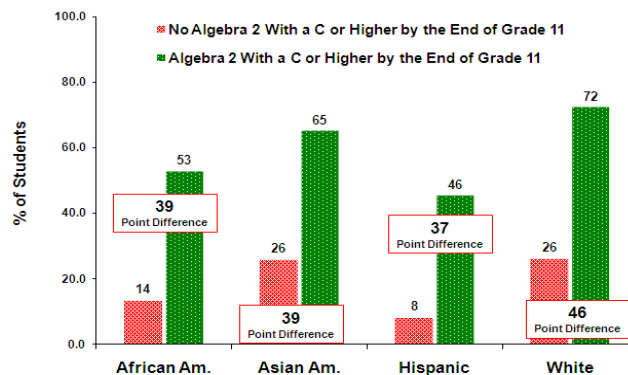
Among students in the Classes of 2001 to 2004, 93 percent who completed Algebra 2 with a C or higher by the end of Grade 11 enrolled in college. Of those students, 81 percent stayed in college and earned credits toward a degree, and 67 percent earned a bachelor's degree within six years. Likewise, 73 percent of MCPS students who

had not completed Algebra 2 with a C or higher by the end of Grade 11 enrolled in college, a rate higher than the national average of about 69 percent (Bureau of Labor Statistics, 2009). However, of those students, 42 percent stayed in college and earned credits toward a degree, and 19 percent earned a bachelor’s degree within six years.

Narrowing Racial and Ethnic Differences in College Achievement


Algebra 2 completion, while a desired outcome for all high school students, is particularly important for improving college readiness among minority students (Evan, Gray, & Olchefske, 2006; Greene & Forster, 2003; Moses & Cobb, 2001; Pearson, 2009). On average, students who are African American and Hispanic earn fewer high school mathematics credits than their Asian American and White peers and are less likely to successfully complete Algebra 2 (Schoenfeld, 2002). This leaves African American and Hispanic students less prepared for college-level coursework. As is true nationally, MCPS African American and Hispanic students are less likely than Asian American and White students to be exempt from taking remedial mathematics courses upon entry to college (Table A1).

The relationship of Algebra 2 completion with a C or higher by the end of Grade 11 and college degree attainment was particularly striking for African American and Hispanic students in the MCPS Classes of 2001 to 2004. African American students who completed Algebra 2 with a C or higher by the end of Grade 11 earned college degrees at rates that were nearly four times that of other African American students. Hispanic students who completed Algebra 2 with a C or higher by the end of Grade 11 earned college degrees at rates that were more than five times that of other Hispanic students (Figure 3).



Note: Point Differences calculated on rounded values may differ by 1 point from differences calculated on rounded values shown in graph.

Figure 3. Percentage of graduates in the MCPS Classes of 2001 to 2004 who earned a bachelor’s degree within six years by race/ethnicity and Algebra 2 status.



Regardless of race and ethnicity, more than 50 percent of students in the MCPS Classes of 2001 to 2004 who completed Algebra 2 with a C or higher by the end of Grade 11 earned a bachelor's degree within six years. Among students of the same race and ethnicity, students who had completed Algebra 2 with a C or higher by the end of Grade 11 earned bachelor's degrees at rates that were about 40 percentage points higher than that of students without that level of mathematics preparation.

Discussion

High school mathematic attainment is one of the best predictors of success in college and the workplace. MCPS has identified completion of Algebra 2 with a C or higher as one of seven keys to college readiness for all students (Von Secker, 2009). Nationally, completion of Algebra 2 in high school is significantly correlated with college success and future employment earnings (Achieve, Inc., 2006; Pascarella & Terenzini, 1991; U.S. Department of Education, 2008). In MCPS, completion of Algebra 2 with a C or higher by the end of Grade 11 is associated with greater likelihoods of college readiness, college enrollment, college persistence, and college degree completion (Tables A1 to A4).

While Algebra 2 performance by the end of Grade 11 is highly correlated with postsecondary success, it is not the only indicator of high school students' college readiness. Opportunity to learn, targeted instruction, student motivation, and many other factors influence performance during and after high school. Parents, teachers, and school leadership should consider multiple sources of information, including evidence from day-to-day interactions with students, to identify individuals' strengths and support students' college readiness during high school and beyond.

High school students who successfully complete Algebra 2 with a C or higher by the end of Grade 11 are more likely to—

- be prepared for college-level mathematics courses;
- enroll in college;
- stay in college (persist); and
- earn a bachelor's degree.



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Table A1
Number of MCPS Graduates and Number and Percentage of MCPS Graduates Who Were College Ready in Mathematics
(Unlikely To be Required to Take Remedial Mathematics Courses Upon Entry to College^a) by
Race/Ethnicity and Grade 11 Algebra 2 Status

Graduation Class Race/Ethnicity	All Students			Completed Algebra 2 with a C or Higher by the End of Grade 11			Did Not Complete Algebra 2 with a C or Higher by the End of Grade 11		
	N MCPS Graduates	N College Ready	% College Ready	N MCPS Graduates	N College Ready	% College Ready	N MCPS Graduates	N College Ready	% College Ready
Classes of 2001 to 2004	33,788	15,085	44.6	19,713	13,519	68.6	14,075	1,566	11.1
African American	6,492	948	14.6	2,173	812	37.4	4,319	136	3.1
Asian American	5,269	3,276	62.2	3,864	2,939	76.1	1,405	337	24.0
Hispanic	4,214	601	14.3	1,341	514	38.3	2,873	87	3.0
White	17,728	10,241	57.8	12,300	9,237	75.1	5,428	1,004	18.5

Note. Results for American Indian students are included with all students but are not reported separately. Algebra 2 status and remedial likelihood are based on data available in MCPS student records.

^a MCPS high school students who earned SAT math scores of 550 or higher were identified as college ready (unlikely to be required to take remedial mathematics courses upon entry to college). Results may underestimate college readiness because some colleges allow students with SAT math scores below 550 to enroll in credit-bearing mathematics courses without remediation.

Table A2
Number of MCPS Graduates and Number and Percentage of MCPS Graduates Who Enrolled in College^a by
Race/Ethnicity and Grade 11 Algebra 2 Status

Graduation Class Race/Ethnicity	All Students			Completed Algebra 2 with a C or Higher by the End of Grade 11			Did Not Complete Algebra 2 with a C or Higher by the End of Grade 11		
	N MCPS Graduates	N Enrolled in College	% Enrolled in College	N MCPS Graduates	N Enrolled in College	% Enrolled in College	N MCPS Graduates	N Enrolled in College	% Enrolled in College
Classes of 2001 to 2004	33,788	28,607	84.7	19,713	18,346	93.1	14,075	10,261	72.9
African American	6,492	4,997	77.0	2,173	1,958	90.1	4,319	3,039	70.4
Asian American	5,269	4,642	88.1	3,864	3,521	91.1	1,405	1,121	79.8
Hispanic	4,214	2,964	70.3	1,341	1,165	86.9	2,873	1,799	62.6
White	17,728	15,933	89.9	12,300	11,668	94.9	5,428	4,265	78.6

Note. Results for American Indian students are included with all students but are not reported separately. Algebra 2 status is based on data available in MCPS student records. College enrollment status is based on data obtained from the National Clearinghouse in November 2009. Postsecondary records were not available for all graduates.

^a College enrollment is defined as enrolling in a two- or four-year college within six years after high school graduation.

Table A3
Number of MCPS Graduates and Number and Percentage of MCPS Graduates Who Stayed in College (Persisted^a) by Race/Ethnicity and Grade 11 Algebra 2 Status

Graduation Class Race/Ethnicity	All Students			Completed Algebra 2 with a C or Higher by the End of Grade 11			Did Not Complete Algebra 2 with a C or Higher by the End of Grade 11		
	N MCPS Graduates	N Persisted in College	% Persisted in College	N MCPS Graduates	N Persisted in College	% Persisted in College	N MCPS Graduates	N Persisted in College	% Persisted in College
Classes of 2001 to 2004	33,788	21,924	64.9	19,713	16,005	81.2	14,075	5,919	42.1
African American	6,492	3,165	48.8	2,173	1,556	71.6	4,319	1,609	37.3
Asian American	5,269	3,867	73.4	3,864	3,124	80.8	1,405	743	52.9
Hispanic	4,214	1,859	44.1	1,341	938	69.9	2,873	921	32.1
White	17,728	12,991	73.3	12,300	10,360	84.2	5,428	2,631	48.5

Note. Results for American Indian students are included with all students but are not reported separately. Algebra 2 status is based on data available in MCPS student records. College persistence status (remaining in college) is based on data obtained from the National Clearinghouse in November 2009. Postsecondary records were not available for all graduates.

^a College persistence is defined as continued college enrollment even if a degree was not obtained during the six years after high school graduation.

Table A4
Number of MCPS Graduates and Number and Percentage of MCPS Graduates Who Earned a Bachelor's Degree Within Six Years by Race/Ethnicity and Grade 11 Algebra 2 Status

Graduation Class Race/Ethnicity	All Students			Completed Algebra 2 with a C or Higher by the End of Grade 11			Did Not Complete Algebra 2 with a C or Higher by the End of Grade 11		
	N MCPS Graduates	N Earned Degree ^a	% Earned Degree ^a	N MCPS Graduates	N Earned Degree ^a	% Earned Degree ^a	N MCPS Graduates	N Earned Degree ^a	% Earned Degree ^a
Classes of 2001 to 2004	33,788	15,803	46.8	19,713	13,193	66.9	14,075	2,610	18.5
African American	6,492	1,731	26.7	2,173	1,148	52.8	4,319	583	13.5
Asian American	5,269	2,882	54.7	3,864	2,517	65.1	1,405	365	26.0
Hispanic	4,214	845	20.1	1,341	610	45.5	2,873	235	8.2
White	17,728	10,325	58.2	12,300	8,901	72.4	5,428	1,424	26.2

Note. Results for American Indian students are included with all students but are not reported separately. Algebra 2 status is based on data available in MCPS student records. College degree completion status is based on data obtained from the National Clearinghouse in November 2009. Postsecondary records were not available for all graduates.

^a Degree completion is defined as a bachelor's degree or higher from a four-year institution.