Focus on Key 4: Algebra 1 in Middle School is Key to College Readiness

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Grade 8 has long been recognized as a pivotal point in mathematics education and postsecondary planning (U.S. Department of Education, 1995, 1997; Spielhagen, 2006). Nationally, more than 80 percent of Grade 8 students of all races and ethnicities report that they expect to earn a bachelor’s degree or higher (Wimberly & Noeth, 2005). Yet only about 20 percent of Grade 8 students have acquired the knowledge and skills they need to be successful in rigorous high school courses that prepare them for college and the workplace (ACT, 2003, 2004, 2008).

Middle school students who successfully complete Algebra 1 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 (Adelman, 1999, 2006; Atanda, 1999; Finkelstein & Fong, 2008; Raudenbush, Fotiu, & Cheong, 1998; Smith, 1996; U.S. Department of Education, 2008; Von Secker, 2005). Montgomery County Public Schools (MCPS) has identified completion of Algebra 1 with a C or higher by the end of Grade 8 as one of the keys to college readiness (Von Secker, 2009).

The purpose of this accountability update is to present some of the research and data that highlight the value of completing Algebra 1 with a C or higher by the end of Grade 8. Postsecondary outcomes are reported for 33,788 students in the MCPS Classes of 2001 to 2004. Data for MCPS graduates were 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).

Students who complete Algebra 1 by the end of Grade 8 are more likely to be prepared for college mathematics (ACT, 2008). Among MCPS students in the Classes of 2001 to 2004 who completed Algebra 1 with a C or higher by the end of Grade 8, 88 percent were identified as prepared for college mathematics and unlikely to need remediation upon entry to college. Of students who did not complete Algebra 1 with a C or higher by the end of Grade 8, only 26 percent were identified as prepared for college mathematics and unlikely 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 prepared for college mathematics (had SAT math score of 550 or higher) by Algebra 1 status at the end of Grade 8.

**College Enrollment, Persistence, and Degree Attainment**

Algebra 1 is a gateway to postsecondary success and one of the most powerful predictors of bachelor’s degree attainment (ACT, 2004, 2008). Students who take a challenging curriculum, beginning in the middle school, tend to perform better academically in high school and are better prepared for college than those who take less rigorous
courses (Finkelstein & Fong, 2008; Gamoran & Hannigan, 2000; Smith, 1996; Spielhagen, 2006; Von Secker, 2005). The correlation exists in part because Algebra 1 is a prerequisite for many college courses, not only in mathematics and science, but also in social science, economics, business, and technology. In MCPS, college degree attainment rates among students who completed Algebra 1 with a C or higher by the end of Grade 8 are more than two times those of students with lesser preparation (Figure 2).

Among students in the Classes of 2001 to 2004, 95 percent who completed Algebra 1 with a C or higher by the end of Grade 8 enrolled in college. Of those students, 86 percent stayed in college (persisted) and earned credits toward a degree, and 75 percent earned a bachelor’s degree. Likewise, 80 percent of students in the study who had not completed Algebra 1 with a C or higher by the end of Grade 8 enrolled in college, a rate higher than the national average of about 69 percent (Bureau of Labor Statistics, 2009). However, of those students, only 56 percent stayed in college and earned credits toward a degree, and only 34 percent earned a bachelor’s degree.

**Narrowing Racial and Ethnic Differences in College Achievement**

Algebra 1 completion, while a desired outcome for all middle school students, is particularly important for improving college readiness among minority students (Camblin, 2003; 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 1 (Horn & Nuñez, 2000; Schoenfeld, 2002). This leaves African American and Hispanic students less prepared for college-level coursework.

The relationship of Algebra 1 completion with a C or higher by the end of Grade 8 and college degree attainment was particularly striking for African American and Hispanic students in the MCPS Classes of 2001 to 2004 (Figure 3). African American students who completed Algebra 1 with a C or higher by the end of Grade 8 earned college degrees at rates that were three times the rate of other African American students. Hispanic students who completed Algebra 1 with a C or higher by the end of Grade 8 earned college degrees at rates that were nearly four times the rate of other Hispanic students.

![Figure 3](image)

*Figure 3.* Percentage of graduates in the MCPS Classes of 2001 to 2004 who have earned a bachelor’s degree by race/ethnicity and Algebra 1 status.

Seventy-five percent of students in the MCPS Classes of 2001 to 2004 who completed Algebra 1 with a C or higher by the end of Grade 8 earned a bachelor’s degree within six years. Among students of the same race and ethnicity, students who had completed Algebra 1 with a C or higher by the end of Grade 8 earned bachelor’s degrees at rates that were more than 30 percentage points higher than the percentages of students with less mathematics preparation.
Discussion

National emphasis on Algebra 1 completion by the end of Grade 8 has led to more equitable opportunities for students of all races and ethnicities. In the 1990s, access to Algebra 1 in Grade 8 was reserved for about one in six students, few of whom were students of color. Over the last two decades, Grade 8 Algebra 1 enrollment rates nearly doubled to about one in three students. By 2007, Algebra 1 was the most commonly taken Grade 8 mathematics course in the United States and universal access to Algebra 1 by the end of Grade 8 was viewed as a “civil right” for all students (Loveless, 2008; Moses & Cobb, 2001).

The transition from Grade 8 to high school lays the foundation for students’ successful transitions from high school to college and the workplace. Grade 8 students who have completed Algebra 1 are more likely to have the essential knowledge and skills they need to be successful in the high school courses that prepare them for postsecondary success. MCPS students in the Classes of 2001 to 2004 who completed Algebra 1 with a C or higher by the end of Grade 8 were 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 (Tables A1 to A4).

While enrollment in Algebra 1 by the end of Grade 8 is important, enrollment by itself does not guarantee postsecondary success. Students who successfully complete Algebra 1 with a C or higher prior to high school are able to subsequently complete a high school mathematics sequence that includes Algebra 2 and higher level mathematics courses. Middle school mathematics readiness opens doors to rigorous curricular options in high school, which in turn prepare students for success in college courses.

Middle school students who complete Algebra 1 with a C or higher by the end of Grade 8 are more likely to—

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


ACT. (2004). *Crisis at the core: Preparing all students for college and work*. Iowa City, IA: Author.

ACT. (2008). *The forgotten middle: Ensuring that all students are on target for college and career readiness before high school*. Iowa City, IA: Author.


### 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*) by Race/Ethnicity and Grade 8 Algebra 1 Status

<table>
<thead>
<tr>
<th>Graduation Class Race/Ethnicity</th>
<th>All Students</th>
<th>Completed Algebra 1 with a C or Higher by the End of Grade 8</th>
<th>Did Not Complete Algebra 1 with a C or Higher by the End of Grade 8</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N MCPS Graduates</td>
<td>N College Ready</td>
<td>% College Ready</td>
</tr>
<tr>
<td>Classes of 2001 to 2004</td>
<td>33,788</td>
<td>15,085</td>
<td>44.6</td>
</tr>
<tr>
<td>African American</td>
<td>6,492</td>
<td>948</td>
<td>14.6</td>
</tr>
<tr>
<td>Asian American</td>
<td>5,269</td>
<td>3,276</td>
<td>62.2</td>
</tr>
<tr>
<td>Hispanic</td>
<td>4,214</td>
<td>601</td>
<td>14.3</td>
</tr>
<tr>
<td>White</td>
<td>17,728</td>
<td>10,241</td>
<td>57.8</td>
</tr>
</tbody>
</table>

*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**
by Race/Ethnicity and Grade 8 Algebra 1 Status

<table>
<thead>
<tr>
<th>Graduation Class Race/Ethnicity</th>
<th>All Enrolled in College</th>
<th>Completed Algebra 1 with a C or Higher by the End of Grade 8</th>
<th>Did Not Complete Algebra 1 with a C or Higher by the End of Grade 8</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N MCPS Graduates</td>
<td>N Enrolled in College</td>
<td>% Enrolled in College</td>
</tr>
<tr>
<td>Classes of 2001 to 2004</td>
<td>33,788</td>
<td>28,607</td>
<td>84.7</td>
</tr>
<tr>
<td>African American</td>
<td>6,492</td>
<td>4,997</td>
<td>77.0</td>
</tr>
<tr>
<td>Asian American</td>
<td>5,269</td>
<td>4,642</td>
<td>88.1</td>
</tr>
<tr>
<td>Hispanic</td>
<td>4,214</td>
<td>2,964</td>
<td>70.3</td>
</tr>
<tr>
<td>White</td>
<td>17,728</td>
<td>15,933</td>
<td>89.9</td>
</tr>
</tbody>
</table>

*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.

Note. Results for American Indian students are included with all students but are not reported separately. Algebra 1 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.

*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) by Race/Ethnicity and Grade 8 Algebra 1 Status**

<table>
<thead>
<tr>
<th>Graduation Class</th>
<th>Race/Ethnicity</th>
<th>All Students</th>
<th>Completed Algebra 1 with a C or Higher by the End of Grade 8</th>
<th>Did Not Complete Algebra 1 with a C or Higher by the End of Grade 8</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>N MCPS</td>
<td>N Persisted in College</td>
<td>% Persisted in College</td>
</tr>
<tr>
<td>Classes of 2001 to 2004</td>
<td></td>
<td>Graduates</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>African American</td>
<td>6,492</td>
<td>3,165</td>
<td>48.8</td>
</tr>
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<td></td>
<td>Asian American</td>
<td>5,269</td>
<td>3,867</td>
<td>73.4</td>
</tr>
<tr>
<td></td>
<td>Hispanic</td>
<td>4,214</td>
<td>1,859</td>
<td>44.1</td>
</tr>
<tr>
<td></td>
<td>White</td>
<td>17,728</td>
<td>12,991</td>
<td>73.3</td>
</tr>
</tbody>
</table>

Note. Results for American Indian students are included with all students but are not reported separately. Algebra 1 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.

### 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 8 Algebra 1 Status**

<table>
<thead>
<tr>
<th>Graduation Class</th>
<th>Race/Ethnicity</th>
<th>All Students</th>
<th>Completed Algebra 1 with a C or Higher by the End of Grade 8</th>
<th>Did Not Complete Algebra 1 with a C or Higher by the End of Grade 8</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>N MCPS</td>
<td>N Earned Degree</td>
<td>% Earned Degree</td>
</tr>
<tr>
<td>Classes of 2001 to 2004</td>
<td></td>
<td>Graduates</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>African American</td>
<td>6,492</td>
<td>1,731</td>
<td>26.7</td>
</tr>
<tr>
<td></td>
<td>Asian American</td>
<td>5,269</td>
<td>2,882</td>
<td>54.7</td>
</tr>
<tr>
<td></td>
<td>Hispanic</td>
<td>4,214</td>
<td>845</td>
<td>20.1</td>
</tr>
<tr>
<td></td>
<td>White</td>
<td>17,728</td>
<td>10,325</td>
<td>58.2</td>
</tr>
</tbody>
</table>

Note. Results for American Indian students are included with all students but are not reported separately. Algebra 1 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.