



**Achievement at an Advanced Level Among Secondary  
Students: Changes Over Time and  
Options that Support Black or African American and  
Hispanic/Latino Students**

**Office of Shared Accountability**

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**Elizabeth Cooper-Martin, Ph.D.**



**OFFICE OF SHARED ACCOUNTABILITY**

**850 Hungerford Drive  
Rockville, Maryland 20850  
301-279-3553**

**Dr. Jack R. Smith  
Superintendent of Schools**

**Dr. Janet S. Wilson  
Associate Superintendent**

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## Executive Summary

At the request of the Chief Academic Officer, the Office of Shared Accountability conducted a study of successful secondary students in Montgomery County Public Schools (MCPS) and what helped them to achieve academic success. The study first examined performance at the advanced level over time. In response to the finding that Black or African American and Hispanic/Latino students were less likely to stay at an advanced level of achievement from Grade 8 to 12, the study identified curricular options and high school programs that supported advanced performance by these students as they went on to complete high school. The specific research questions were as follows:

1. What is the level of achievement at the advanced level among secondary students over time? Specifically, what percentage of students performed at an advanced level in Grade 8 and then continued as high achievers at the end of high school? Which students were most likely to stay at the advanced level over time, from Grade 8 to the end of high school?
2. Which high school programs or curricular options were most promising in supporting Black or African American and Hispanic/Latino students to continue achieving at an advanced level at the end of high school?
3. With respect to the programs and curricular options identified in question 2, what are the characteristics or components of each one? What are common aspects across them?

### Summary of Methodology

For question 1, the study sample was all students who completed Grade 8 in MCPS in 2008–2009. For questions 2 and 3, the sample was limited to those Black or African American and Hispanic/Latino students who were high achievers in Grade 8 and also completed Grade 12 in MCPS. Measures of high achievement in Grade 8 were advanced level on the Maryland School Assessments in mathematics; grade of B or higher in a mathematics course (Algebra I or higher); and a score of 231 or higher on Measures of Academic Progress assessments in reading. Measures of high achievement for the end of high school were a score of 1650 or higher (out of 2400) on the SAT or a score of 24 or higher on the ACT; a score of 3 or higher on an Advanced Placement (AP) exam or a score of 4 or higher on an International Baccalaureate (IB) exam; and completion of a rigorous high school program as defined by the Maryland State Department of Education. In each grade level, students had to meet only one of the measures to be classified as high achievers for this study.

Participation in curricular options that support advanced learning (i.e., Advanced-level, AP, Honors, or IB courses) was based on course completion records. Program codes from the Online Administrative Student Information System (OASIS) database were used to identify participants in choice, magnet, or signature programs that support advanced learning. Because the data in OASIS was incomplete, additional approaches (e.g., analysis of course completion) were used, but it was not possible to identify participants for all programs. Analyses included descriptive statistics for all questions plus measures of statistical and practical significance where appropriate.

### Summary of Findings

*Question 1.* Nearly one out of six (59%) students in Grade 8 performed at an advanced level. Among these advanced eighth graders who were still enrolled in MCPS for Grade 12, more than three quarters (76%) continued to perform at an advanced level at the end of high school. Several subgroups were more likely to stay at the advanced level from Grade 8 to 12: females, Asian or

White students, students who had never received English for Speakers of Other Languages, students who had never received Free and Reduced-price Meals System services, and non-recipients of special education services.

*Question 2.* Ten programs and curricular options (some of which overlapped) were identified as the most promising in supporting high-achieving, Grade 8 Black or African American and Hispanic/Latino students to continue advanced achievement. They included four programs in which all or nearly all participants finished high school at an advanced level:

- CAP at Montgomery Blair HS
- Global Ecology or Humanities House at Poolesville HS
- IB at Richard Montgomery HS
- Science, Mathematics, & Computer Science at Montgomery Blair HS and Poolesville HS

The remaining six promising programs and curricular options were those with the greatest impact (as measured by effect sizes of practical significance) on supporting high-achieving, Grade 8 Black or African American and Hispanic/Latino students to continue as high achievers at the end of high school:

- Six or more semesters of Advanced-level courses
- Six or more semesters of AP courses
- Four or more semesters of IB courses
- Local IB programs at seven high schools
- Signature programs that require AP courses at four high schools (i.e., APEX, APPS, Humanities & Arts, PEAC)
- Ulysses Signature Program at Northwest HS

*Question 3.* Descriptions of each promising program and curricular option are in Appendix B. Each of them required rigorous courses; 6 of the 10 required applications; and 4 or 5 required a research project during the student's senior year.

## Recommendations

The report's findings suggest the following recommendations to support continued achievement of Black or African American and Hispanic/Latino students:

- Institute districtwide strategies that, starting in middle school, encourage high-achieving Black or African American and Hispanic/Latino students to enroll in IB programs; signature programs that require AP courses; or at least two, year-long Advanced-level, AP, or IB courses. Augment course bulletins to indicate which courses are Advanced-level.
- Consider establishing a signature program or modify an existing signature program to require AP courses at the 10 high schools without such a program or an IB program.
- Consider expanding the availability of Advanced-level, AP, and IB courses and the size of IB and signature programs to support increased enrollment in them.

The difficulty in identifying student participation in programs limited the study's analyses and findings. The final recommendations on future research include one to avoid these difficulties:

- Develop a monitoring system to ensure that staff members at every school consistently and completely enter program codes for participants for every year of the program.
- Confirm the findings by replicating the research with a more recent class of MCPS graduates.



## **Achievement at an Advanced Level Among Secondary Students: Changes Over Time and Options that Support Black or African American and Hispanic/Latino Students**

### **Problem Statement and Rationale**

The mission of Montgomery County Public Schools (MCPS) is to ensure every student has the academic, creative problem solving, and social emotional skills they need to be successful in college and careers as reflected in the district’s Strategic Planning Framework—*Building Our Future Together: Students, Staff and Community* (MCPS, 2015a). This framework makes clear the district’s commitment to education, such that “academic success is not predictable by race, ethnicity, gender, socioeconomic status, language proficiency, or disability.”

Although MCPS has narrowed the gap in performance among racial subgroups in some areas, including graduation rate, dropout rate, and access to rigorous classes, gaps in achievement remain in other areas and, in some cases, have increased (MCPS, 2015a). For example, with respect to reading achievement in Grade 8 in 2013–2014, the majority of students in every subgroup, except those receiving English language or special education services, met or exceeded the benchmark for proficiency (Figure 1). The largest gap among racial/ethnic groups was 26 percentage points between Hispanic/Latino and White students. However, for reading at the advanced level, less than one half of most subgroups met this benchmark; further, the largest gap among racial/ethnic groups, again between Hispanic/Latino and White students, was 43 percentage points (Figure 1).

Clearly there are differences in the percentages of students who reach various educational milestones, but it is worth noting that there are students from every subgroup who do attain those milestones. Therefore, at the request of the Chief Academic Officer, the Office of Shared Accountability conducted this study of successful students and what helped them to achieve academic success. The study first examined performance at the advanced level over time, including analysis by subgroup. In response to these findings, the second part of the study focused on identifying those MCPS programs and curricular options that supported advanced levels of performance by Black or African American and Hispanic/Latino students as they went on to complete high school. Specifically, the focus was programs and other curricular options that MCPS provides to students who have the ability, motivation, or potential to perform at high levels.

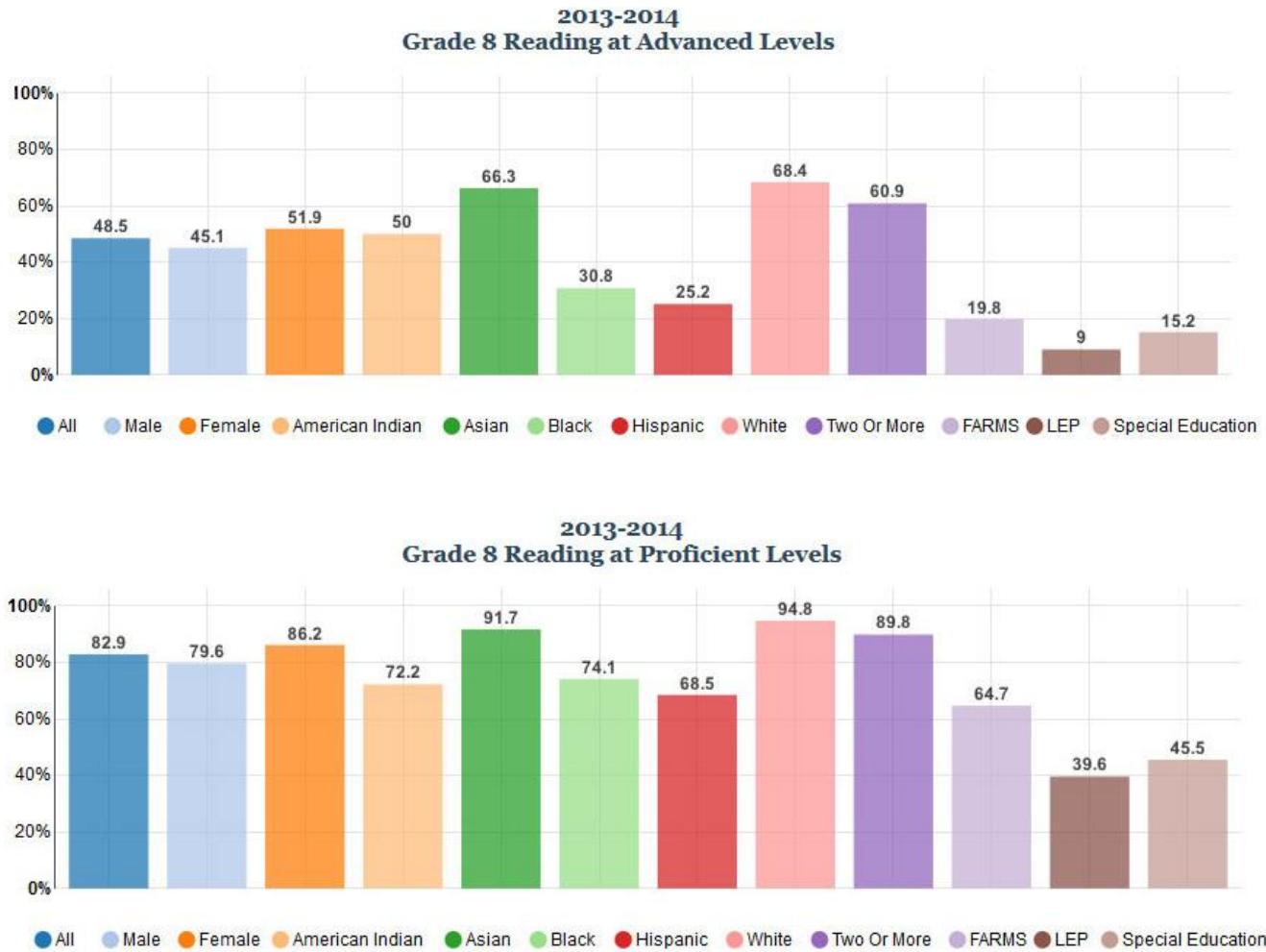


Figure 1. Percentages of Grade 8 students reading at the proficient and advanced levels in 2013–2014 for total and for subgroups. Source MCPS (2015a).

## Background

### Programs and Curricular Options for Advanced Level Learning in High School

MCPS supports high school students with the ability, motivation, or potential to perform at high levels through programs, coursework, and other curricular options, as follows (MCPS, 2015b).

*Programs.* A program refers to a set of required and elective courses designed to meet specific academic goals. Choice options for high school (HS) programs that support advanced level learning include (MCPS, 2015b & 2015c):

- Programs that require applications (and may have a limited number of openings) and are open to all MCPS high school students:
  - Global Ecology House: Poolesville HS
  - International Baccalaureate Magnet Program (IB): Richard Montgomery HS
  - Technology: Thomas Edison High School of Technology
  - Visual Art Center: Albert Einstein HS
- Programs that require applications and are limited to students eligible to attend certain MCPS high schools:
  - Humanities House: Poolesville HS
  - Science, Mathematics, and Computer Science: Montgomery Blair HS and Poolesville HS
- Programs that require applications and are limited to Downcounty Consortium (DCC) residents or students attending a DCC middle school:
  - Biomedical Magnet Program: Wheaton HS
  - Communication Arts Program (CAP): Montgomery Blair HS
  - Engineering Magnet Program: Wheaton HS
  - Leadership Training Institute: John F. Kennedy HS
- Gifted and talented/learning disabled programs that require placement as a result of the Individual Education Program process and are open to all MCPS high school students:
  - Walter Johnson HS
  - Northwood HS
  - Watkins Mill HS
- Local IB programs that are limited to students enrolled at the following high schools:
  - Bethesda-Chevy Chase HS
  - Albert Einstein HS
  - John F. Kennedy HS
  - Rockville HS
  - Seneca Valley HS
  - Springbrook HS
  - Watkins Mill HS

*Coursework.* Options for advanced level learning include Honors, Advanced Placement (AP), and Advanced-level courses, all of which provide rigorous and challenging studies (MCPS, 2015d). A variety of Honors and AP courses in multiple content areas are available at each MCPS

high school to any student who demonstrates the motivation or potential to perform at high levels. Each Honors course includes curriculum adaptations for accelerated and enriched learning. AP courses are those courses for which a College Board Advanced Placement examination exists. Advanced-level courses are based upon previous achievement in a sequence of study; these courses are available in several content areas, including information technology/computer science, foreign languages, mathematics, and science. Students may enroll in individual Honors, AP, or Advanced-level courses; there is not a requirement to enroll in an Honors, AP or Advanced-level program. IB courses also provide rigorous and challenging studies, both to students enrolled in this program and students who take individual IB courses, without enrolling in the full program. (The option to take individual IB courses is available at six of the eight high schools that offer the IB program.)

*Other curricular option.* Another advanced level curricular option for MCPS high school students is dual enrollment, which is completing college or university courses while enrolled in high school. However, this option is dependent on the student's grade point average (GPA).

### **Signature Programs**

Many MCPS high schools offer signature programs that “integrate a specific focus or distinguishing theme with the skills, concepts, and instructional strategies of some portion of a school's curriculum” and are limited to students enrolled at the school (MCPS 2015e). The following signature programs require applications; and all, except for the two at Churchill HS, also require enrollment in AP or honors classes<sup>1</sup>:

- Advanced Placement Experience Scholars (APEX) Program: Walter Johnson HS
- Advanced Placement Power Scholars (APPS): Clarksburg HS
- Creative & Performing Arts and Mathematics, Technology, & Science: Winston Churchill HS
- Humanities & Arts: Wootton HS
- Pursuing Excellence in the Academic Curricula (PEAC) Scholars: Col. Zadok Magruder HS
- Ulysses Program: Northwest HS

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<sup>1</sup> The AP Scholar Program at Quince Orchard High School that awards certificates at the end of high school was excluded because students do not join the program earlier in high school.

## Literature Review

This review focuses on studies of changes in advanced level performance over time and of advanced level performance for Black or African American and Hispanic/Latino students.

### Changes in Performance Over Time for Advanced-level Students

*National studies.* In a study focused on high-achieving students from low-income families, Wyner, Bridgeland, and DiIulio (2007) defined high achievers as those who scored in the top quarter on a nationally normed standardized test and low income as a family income below the national median. As first graders, these high-achieving students were demographically (other than income) and geographically very similar to all U.S. first graders. However, based on a longitudinal study, more of these high-achieving students from low-income families fell out of the high achievement group in elementary and high school than their higher income peers.

In a comprehensive study of differences in achievement between subgroups at the highest levels of student performance, Plucker, Burroughs, and Song, labeled these differences “excellence gaps” (2010, p. 2). These authors used the National Assessment of Educational Progress (NAEP) program that reports student performance in four categories, including advanced. Based on results for Grades 4 and 8 from 1998 to 2007, they identified excellence gaps in every year for both mathematics and reading, with lower performance by Blacks vs. Whites, and Hispanics vs. Whites, and also for English Language Learners (ELLs) vs. non-ELLs, and students eligible for Free and Reduced-price Meals System (FARMS) vs. non-eligible students. These gaps persisted or widened over the years under study. Other studies also found that gaps increased over time more for advanced students than for students with lower levels of achievement.

Plucker, Hardesty, and Burroughs (2013a) updated their earlier study with data from 2011. They found that the excellence gaps had increased among racial/ethnic groups, including gaps in favor of Asian/Pacific Islander students compared to Black, Hispanic, and White students, along with gaps between ELLs vs. non-ELLs and recipients vs. non-recipients of FARMS. Excellence gaps widened because there were increases in the percentages of the Asian/Pacific Islander, White, non-FARMS, and non-ELL students who scored at the advanced level, especially in mathematics, while, for the other groups, the percentage of students scoring at the advanced level was essentially stable. Based on NAEP scores for Grades 4 and 8, they concluded that progress within the country in closing achievement gaps at the proficient level was unrelated to changes in excellence gaps. Likewise, Bidwell (2013) presented evidence that achievement gaps among students who perform at an advanced level actually increased during the No Child Left Behind era, when policy incentives and disincentives focused on improving achievement of students performing at below grade level.

Xiang, Dahlin, Cronin, Theaker, and Durant (2011) studied individual, high-achieving students, defined as those who scored at or above the 90<sup>th</sup> normed percentile on the Measures of Academic Progress assessments in mathematics (MAP-M) or reading (MAP-R). (Their sample came from a database of 4,800 public school systems.) Like the proposed study, these authors looked at students at two points in time; specifically, they examined one cohort in Grade 3 and again in Grade 8 and a second cohort in Grade 6 and again in Grade 10. A majority of high achievers in both cohorts

(52–70%) maintained their status; for example, 56% of high achievers in Grade 6 reading were still high achievers in reading at Grade 8. Due to other students moving to the high achievement level, the percentage of high achievers in each subject grew slightly for both cohorts. Movement into and out of the high achievement level was concentrated among students with scores between the 70<sup>th</sup> and 90<sup>th</sup> percentiles; in other words, few students moved from low levels of achievement to high levels. The proportions of African American, Hispanic, and Native American students in high achieving groups were stable over time (7–9%).

***State studies.*** Research about students in a variety of states reflect the trend in national studies that gaps increased over time more for advanced students than for students with lower levels of achievement.

In a longitudinal study of students in **Texas** public schools, Hanushek and Rivkin (2006) divided third graders into groups, based on reading levels and then examined the changes in the Black–White achievement gap from Grade 5 to Grade 8 for each group. They found the increase in the Black–White achievement gap was largest for the students who in Grade 3 had the highest levels of reading. By comparison, for students with the lowest levels of reading in Grade 3, the increase in the Black–White achievement gap from Grade 5 to Grade 8 was smaller or negative.

Similarly, when Clotfelter, Ladd, and Vigdor (2009) examined changes over time as the same group of students advanced through school, they found that racial achievement gaps between low-performing students tended to get smaller as students progressed through school, while the racial achievement gaps between high-performing students increased. The gaps were between White students and American Indian, Black, and Hispanic students. The study’s sample was students who attended **North Carolina** public schools in Grade 3 and for five years subsequently, including students who repeated a grade.

In their later study, Plucker, Hardesty, and Burroughs (2013b) provided profiles of the gap in achievement at the advanced level for each state. In **Maryland**, relatively few students had advanced scores on NAEP for 2003, 2007, or 2011; the highest rate was 20% among Grade 4 students not receiving FARMS on reading in 2011. Nonetheless, based on NAEP scores, there were gaps of 5–16 percentage points every year in the excellence gap in favor of White vs. Black students, and White vs. Hispanic students, as well as non-ELL vs. ELL students and non-recipients vs. recipients of FARMS. For the Maryland School Assessments (MSA), these authors presented data for Grades 4 and 8 in reading and math for 2004–2011 plus high school reading and Algebra data for the same years, when available. There were double-digit gaps every year in favor of White vs. Black students, White vs. Hispanic students, and non-recipients vs. recipients of FARMS.

***Study in MCPS*** The Office of Legislative Oversight for Montgomery County analyzed changes in achievement gaps among MCPS students from 2007 to 2012 and from 2010 to 2012 (Bonner-Tompkins, Richards, & Scruggs, 2013). This study examined racial/ethnic gaps, along with gaps related to receipt of the following services: English for Speakers of Other Languages (ESOL), Free and Reduced-price Meals System (FARMS), and special education. Their findings indicated that MCPS narrowed the achievement gaps on three of four grade-level measures: school readiness, MSA proficiency in reading and math, and graduation rate, and also on two of three at-risk measures: suspension rates and academic ineligibility in middle school. However, the

achievement gap widened for four measures that the Office of Legislative Oversight identified as above-grade-level:

- Advanced level on MSA in Grades 3, 5, and 8
- Algebra I by Grade 8 with C or higher
- Score of 3 or higher on AP exam or score of 4 or higher on IB exam
- SAT 1650 or higher/ACT 24 or higher

### **Advanced Level Performance of Black or African American and Hispanic/Latino Students**

*Recommended strategies and programs* Ford (2004) proposed a model or framework to address the needs of students who are gifted and culturally diverse. The framework recommends modifying the content, process, product, and learning environment to deliver gifted education and also to deliver multicultural education (see Table 1).

Table 1  
Ford's Framework to Address Educational Needs of Students who are Gifted and Culturally Diverse

	Gifted education	Multicultural education
Content	Content is modified through the use of more advanced or complex concepts, abstractions, and materials.	Content is modified to include greater focus on multicultural concepts, issues, themes, events, and persons. Curricular resources and materials are multicultural.
Process	Activities are redesigned or restructured to be more intellectually demanding. Higher level thinking, problem solving, inquiry-based learning are used, as well as acceleration.	Instructional strategies, including teaching styles, are modified to match more closely the learning and cognitive styles of culturally diverse students. Students' cultural backgrounds and characteristics are given substantive consideration in instructional practices.
Product	Students share their learning in varied ways, particularly by producing products that are authentic, address real issues, and have real audiences.	Students share their learning in many ways, but a multicultural focus is always present to some degree. Students develop products that address issues and solve problems germane to culturally diverse populations.
Learning environment	Teachers create environments that are safe, non-judgmental, and student-centered such that students are at ease in taking intellectual and creative risks. Teachers create a sense of community in which all gifts and talents are valued and respected.	Teachers create learning environments that affirm students' identity as cultural beings; teachers use the cultural characteristics of diverse groups to create a learning community where all individuals are valued and respected.

Briggs and Reis (2004) conducted case studies of seven gifted education programs, to determine their success with groups of culturally, linguistically, and ethnically diverse students. Two programs targeted high school students. Project College Bound (in the Los Angeles Unified School District) focused on a group of culturally diverse students from low income families. While in Grades 10–12, students received information and support to help them pursue college opportunities. The program also involved parents and local high school college counselors.

Almost all students in the first graduating group enrolled in college. A second program, the Mentor Connection (on the University of Connecticut Storrs campus), gave juniors and seniors an opportunity to explore a professional interest for three weeks. Special efforts were made to include a culturally diverse group. The program concluded that about 30% of participants subsequently attended the University of Connecticut due to the Mentor Connection.

Olszewski-Kubilius and Clarenbach (2012) focused on low-income, high-achieving students and stressed that strategies to support students impacted by poverty differed from those to support students of different racial/ethnic groups. Based on examinations of several programs that targeted low-income, high ability students and enabled more of them to improve their academic achievement and success in school, the authors identified the following best practices:

- 1) Gateway programs. Programs focused on preparation of students for advanced courses or programs at the next level of schooling to equip them to make these critical transitions.
- 2) Program selection criteria matched to level of developed talent. Selection criteria included multiple measures, did not use cutoff scores, and relied on holistic assessments to identify students who were both interested in and committed to achievement.
- 3) High-powered curriculum. Courses were challenging and enriched. Teachers provided scaffolding for advanced thinking and questioning skills, not remediation. Professional development of teachers was extensive and focused on changing teacher attitudes and expectations away from a deficit viewpoint.
- 4) Significantly expanded learning time. Students spent more time in classes, usually outside of the normal school day, such as after school, on weekends, and during summer or other breaks.
- 5) Providing program components that equalize opportunities. Programs provided services or connections that more affluent families could access, such as tutors, private college counselors, and contact with adults who could offer internships or career information.
- 6) Augmenting student support networks. Students were in classes with others who were smart and talented and could provide peer support. Some programs also assigned adult mentors or included parent education components.

***Studies in MCPS.*** One study identified MCPS middle schools with sustained success in narrowing the gap between Asian American and White students and African American and Hispanic students (Cooper-Martin, 2012). The goal was to identify school-level policies, strategies, and practices that helped to close the achievement gap. Some, although not all, of the data points in this study reflected achievement at an advanced level in reading or mathematics. Members of the teaching staff at every middle school completed an online survey. Survey items with responses that differed significantly between middle schools with sustained success in narrowing the gap and the remaining middle schools were identified. These items related to one of the following three themes: 1) school leadership for learning, teaching, and equity; 2) teacher support for use of data; and 3) school culture.

A second study explored the postsecondary institution activity of African American and Hispanic graduates of MCPS from 2001 to 2010 (Addison-Scott & Maina, 2012). Reflecting both Hoover's Vindicationist Philosophy (1990) and Harper's Anti-Deficit Achievement Framework (2010), the study focused on achievement as opposed to "gaps." Overall, 76% of the African American and



65% of the Hispanic 2001–2010 MCPS graduates enrolled in a postsecondary institution at some time after graduation. Among African American or Hispanic students who graduated in 2008 or later and who enrolled in college, nearly all enrolled in college within one year after high school graduation. Among older graduates (i.e., the MCPS classes of 2001 to 2006), 30% (3,837) earned a bachelor’s degree or higher within six years of high school graduation, and close to one half of those who had not finished within six years had earned their degree by May 2011. Among younger graduates (i.e., the MCPS classes of 2007 to 2010), more than 8 out of 10 were enrolled as full-time students as of May 2011.

## Scope of the Study

The goal of this study was to explore achievement at the advanced level, with a focus on identifying those programs and curricular options that supported advanced levels of performance by Black or African American and Hispanic/Latino students as they went on to complete high school.

### Research Questions

1. What is the level of achievement at the advanced level among secondary students over time?
  - a. What percentage of students performed at an advanced level in Grade 8?
  - b. Among students who performed at an advanced level in Grade 8, what proportion continued as high achievers at the end of high school?
  - c. Which students were most likely to stay at the advanced level over time, from Grade 8 to the end of high school?
2. Which high school programs or curricular options were most promising in supporting Black or African American and Hispanic/Latino students to continue achievement at an advanced level at the end of high school?
  - a. In which programs or options were high-achieving Black or African American and Hispanic/Latino Grade 8 students most likely to continue as high achievers at the end of high school?
  - b. Which programs or options had the most impact on supporting Black or African American and Hispanic/Latino Grade 8 students to continue as high achievers at the end of high school?
3. With respect to the programs and curricular options identified in question 2,
  - a. What are the characteristics or components of each program or option? What are common aspects across the programs and curricular options?
  - b. How many students participated by demographic and service subgroups in each program or curricular option?
  - c. How did Black or African American and Hispanic/Latino students in each of the programs or curricular options perform, compared to their White and Asian peers in that program or option, on state and district performance measures?

## Methodology

### Study Sample

The study sample was a cohort of students who completed Grade 8 in MCPS in the 2008–2009 school year.

### Measures of Achievement

**Grade 8.** To identify Grade 8 students achieving at an advanced level, the study used measures of both reading and mathematics. Program staff helped determine appropriate measures. One measure was performance on the Grade 8 Maryland School Assessments (MSA) in mathematics; specifically, whether students achieved an advanced level. Although MSA scores have become less aligned with the curriculum and thus less useful since 2012–2013, when MCPS introduced the Common Core curriculum, the students in the study sample were 8<sup>th</sup> graders in 2008–2009. Thus, when these students were in Grade 8, instruction was aligned to the MSA tests and it is appropriate to use their MSA test results. A second measure of achievement at the advanced level was performance in a mathematics course, specifically, earning a grade of B or higher (both semesters) in Algebra 1 (or a higher level math course) in Grade 8. The third measure, in reading, was a score of 231 or higher on the Measures of Academic Progress assessments in reading (MAP-R) (Zhao, 2011). In summary, there were three indicators of high achievement in Grade 8 (Table 2). A student only needed to meet one of them to be identified as a high achiever in Grade 8.

Table 2  
Measures of Student Achievement by Grade Level

Grade level & districtwide milestones	Data point for high achievement <sup>a</sup>
<b>Grade 8:</b>	
<ul style="list-style-type: none"> <li>• Mathematics at the advanced level</li> <li>• Reading at the advanced level</li> </ul>	<ul style="list-style-type: none"> <li>• Advanced level on MSA mathematics test</li> <li>• Mathematics course (Algebra I or higher) with a grade of B or higher in Grade 8</li> <li>• MAP-R score of 231 or higher</li> </ul>
<b>Grade 12</b>	
<ul style="list-style-type: none"> <li>• SAT 1500 or higher (out of 2400) or ACT 21 or higher</li> <li>• Score of 3 or higher on AP exam or Score of 4 or higher on IB exam</li> <li>• On-time graduation</li> </ul>	<ul style="list-style-type: none"> <li>• SAT 1650 or higher (out of 2400) or ACT 24 or higher</li> <li>• Score of 3 or higher on AP exam or Score of 4 or higher on IB exam</li> <li>• Completion of a rigorous high school program (as defined by the Maryland State Department of Education)</li> </ul>

<sup>a</sup>See text for definitions and details.

**Grade 12.** When the students in the study graduated from MCPS, the districtwide milestone for performance on SAT or ACT tests was 1650 or higher (out of 2400) on the SAT and 24 composite score for the ACT. Although MCPS lowered the milestone for the SAT and ACT during fall 2015 (Lang, 2015), the earlier one was used; it was higher, which seemed more appropriate for a study of high achievement, and was in effect when these students graduated.

The second districtwide milestone for performance by the end of Grade 12 is a score of 3 or higher on an AP exam or a score of 4 or higher on IB exam. This milestone was used as a measure of high achievement because the Office of Legislative Oversight for Montgomery County identified it as above grade level, along with the 1650 SAT/24 ACT milestone, in their analysis of student achievement (Bonner-Tompkins, Richards, & Scruggs, 2013).

The third districtwide milestone for performance by the end of Grade 12 is on-time graduation. As a measure of high achievement that was similar to this milestone, this study used completion of a rigorous high school program, using the following definition from the Maryland State Department of Education (MSDE, 2014): a student who has mastered four of the following six indicators has completed a rigorous high school program:

- Two or more credits in the same foreign language with a grade of B or higher
- One or more credits in mathematics courses at a level higher than Algebra 2 and Geometry with a grade of B or higher
- Four credits of science with a grade of B or higher
- Two or more credits of approved advanced technology education<sup>2</sup> with a grade of B or higher
- A score of 1000 or higher on SAT-1 or a score of 20 or higher on ACT, or both
- A cumulative GPA of 3.0 or higher on a 4.0 scale

In summary, there were three indicators of high achievement by the end of Grade 12 (Table 2 above). Students only needed to meet one of them to be identified as a high achiever at the end of high school:

- SAT 1650 or higher (out of 2400) or ACT 24 or higher
- Score of 3 or higher on AP exam or Score of 4 or higher on IB exam
- Completion of a rigorous high school program as defined by MSDE (see previous paragraph)

## Data Sources

Student-level information from appropriate MCPS databases was downloaded to provide the measures for high achievement, program codes, course completion records, and demographic and other descriptors about students to answer research questions 1 and 2. Program information on the MCPS website was the source for descriptions of each program to answer question 3a.

## Measures of Programs and Curricular Options

Program codes from the Online Administrative Student Information System (OASIS) data base were used to identify student participation in magnet, choice, or signature programs. Because some schools did not provide any codes and because no participants were identified in OASIS for some programs, additional approaches were necessary, as follows. Students who completed the

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<sup>2</sup> Advanced technology education courses allow students to develop in-depth skills and knowledge related to one or more of the following areas – impacts of technology, technological issues, engineering design (MSDE, 2016).

IB test for the Theory of Knowledge course while enrolled in MCPS were identified as enrolled in the IB program, along with those identified by program codes from OASIS. Analysis of course completion was used to identify enrollment in the following seven programs: APEX at Walter Johnson High School, APPS at Clarksburg High School, Biomedical Magnet Program at Wheaton High School, Engineering Magnet Program at Wheaton High School, Humanities & Arts at Wootton High School, PEAC Scholars at Col. Zadok Magruder High School, and technology at Thomas Edison High School of Technology. Lastly, no enrollees could be identified from the available program codes and course histories for the following programs: Communication House at Poolesville High School; Gifted and Talented/Learning Disabled at Walter Johnson, Northwood, or Watkins Mill High School; and Visual Art Center at Albert Einstein High School. Therefore, there are no results for these programs.

Also, the complexity of analysis required to identify student participation in magnet, choice, or signature programs was so time consuming that it precluded identification of students outside of the study sample (e.g., Asian or White students). Therefore, there are no findings for questions 3b and 3c.

Records of course completion were used to identify student participation at the end of Grade 12 in four types of courses that support advanced learning: Advanced-level, AP, Honors, and IB (see definitions above). Records of course completion also were used to identify student participation in the dual enrollment program; because only one student in the study sample participated, there are no results for dual enrollment.

### **Analytical Procedures**

In calculating whether a student met an advanced level indicator on Algebra 1 by Grade 8, any student who did not take the course was categorized as not meeting the milestone. Further, a student who did not take any AP or IB exams was categorized as not meeting the advanced level indicator for that measure; all MCPS high schools offer these courses, so all students have the opportunity to take these courses and thus be eligible to take the exam. (The data on AP or IB exams did not indicate whether students had taken the corresponding course.) Likewise, for the SAT/ACT measure, a student who did not take either of the tests was categorized as not meeting the advanced level. This approach, of including students who did not take the relevant course, exam, or test, permitted the inclusion of a greater number of students. Lastly, students who failed to graduate were categorized as not meeting any of the advanced level measures for Grade 12.

Descriptive statistics were used to analyze the findings for the following research questions: questions 1a and 1b on the percentage of students who performed at an advanced level in Grade 8 and then continued as high achievers at the end of high school; question 2a on those programs or options in which high-achieving students were most likely to continue as high achievers; and question 3a on common aspects across the programs and curricular options identified in question 2.

For research question 1c on changes over time, descriptive statistics were used. To determine which groups of students were most likely to stay at the advanced level over time, a  $\chi^2$  test was used to test for statistically significant differences between groups of students. For each  $\chi^2$  test,

the degrees of freedom, which equals the number of student groups minus one, is reported along with the number of students, represented as  $N$ . For example, in an analysis of differences between genders, the number of categories would be two and so the degrees of freedom equals one (i.e., two minus one), as in the following:  $\chi^2(1, N = 3,351) = 6.98$ .

To answer research question 2b on the impact of programs or curricular options,  $\chi^2$  analyses were used to test whether enrollees in each program or option were statistically more likely than non-enrollees to perform at an advanced level at the end of high school. Non-enrollees were limited to students who also had the opportunity to enroll in that program or curricular option, as included in the descriptions above. For example, non-enrollees were limited to students in the same school for signature programs and to schools with IB programs for the curricular option of enrollment in IB courses, while all students in the sample were included for country-wide programs. (See more details on non-enrollees in the footnotes of Table 4.4, below.) For some programs or curricular options, the number of enrollees was much smaller than the number of non-enrollees. However, unequal groups are not a problem for  $\chi^2$  (Greenwood & Nikulin, 1996).

Effect sizes (i.e., Phi) from the  $\chi^2$  analyses were calculated and compared across high school programs and curricular options to identify which programs or options had the most impact on supporting high-achieving students to continue as high achievers. Effect sizes were appropriate for comparisons between programs and curricular options because these measures are metric free and as a result were not affected by the scale of the variables included in the analyses. Effect sizes are tests of practical significance (American Psychological Association, 2001). Phi was interpreted as follows: .10 for a small effect, .30 for a medium effect, .50 for a large effect (Nandy, 2012).

For each of the four types of courses that support advanced learning, chi-square analyses were repeated for a range of semesters (e.g., 4, 6, 8), because students could take more than one year of them. Further, the median number of semesters completed varied across courses from 16 for Honors to 0 for IB (Appendix A). The enrollment level with the largest impact on supporting high-achieving students to continue as high achievers (as indicated by the largest biggest Phi) was included in the findings for question 2b.

### **Strengths and Limitations of the Methodology**

A strength of this study is the use of analysis of course histories and other approaches to confirm program enrollment along with the codes available in OASIS; this approach resulted in including more enrollees and more programs. However, the difficulty of analyzing course histories made it too time-consuming to identify students outside of the subgroup of interest (i.e., Black or African American and Hispanic/Latino) and thus prevented answering questions 3b and 3c. Further, because these additional approaches relied on analysis of all four years of high school to identify students, they could not be used to confirm program enrollment for Grade 9. Therefore, although there was an interest in answering research questions 2a and 2b about programs and options that support advanced achievement at the end of Grade 9, it was not possible to conduct the relevant analyses. Also, despite the use of additional approaches to identification, it was not possible to identify any students for some programs and so the study could not include those programs.

The chi-square tests used to answer question 2b did not control for any differences between enrollees and non-enrollees in each program or curricular option. This lack of controls means that any differences in achievement between enrollees and non-enrollees may be due to other differences between the two groups, rather than due to the program or curricular option. However, the enrollees and non-enrollees were similar in race/ethnicity, grade level, achievement level, and, for some programs, the middle school or high school attended.

In this study of students over time (as in most longitudinal studies), the sample decreased from Grade 8 to Grade 12, as students dropped out or moved out of MCPS. These changes could affect the results, if there was a pattern to which students left MCPS. Lastly, it should be noted that causality may not be inferred from the findings of this study due to the lack of an experimental design.

## Results

### Question 1: What is the Level of Achievement at the Advanced Level Among Secondary Students Over Time?

**Grade 8.** Table 3.1 presents the proportion of students who performed at an advanced level in Grade 8 on each of the three measures or on any of them. The one measure in reading was the score on the MAP-R test; about one half of students (51%) performed at the advanced level on this measure. Fewer students achieved at an advanced level on either of the mathematics measure; about one out of four students scored at the advanced level based on the MSA test (39%) and on their mathematics course grade (42%). Based on any of the three measures, nearly one out of six (59%) Grade 8 students performed at an advanced level in 2008–2009.

Table 3.1  
Proportion of Students in Grade 8 who Performed at the Advanced Level on Three Measures

Student characteristics and service receipt in Grade 8	Total <i>N</i> in Grade 8	Advanced in Grade 8 on							
		MAP-R ( <i>N</i> = 9,851) <sup>a</sup>		MSA mathematics ( <i>N</i> = 10,401) <sup>b</sup>		Mathematics course grade ( <i>N</i> = 10,601)		At least one measure ( <i>N</i> = 10,601)	
		<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
All students	10,601	4,981	50.6	4,022	38.7	4,396	41.5	6,292	59.4
<b>Gender</b>									
Female	5,153	2,588	53.8	2,017	39.9	2,364	45.9	3,216	62.4
Male	5,448	2,393	47.5	2,005	37.5	2,032	37.3	3,076	56.5
<b>Race/ethnicity</b>									
American Indian	30	15	57.7	8	27.6	11	36.7	18	60.0
Asian	1,562	985	66.2	976	63.3	1,026	65.7	1,249	80.0
Black or African American	2,501	730	32.1	391	16.0	495	19.8	960	38.4
Hispanic/Latino	2,293	516	24.1	348	15.8	436	19.0	774	33.8
White	4,215	2,735	69.7	2,299	55.4	2,428	57.6	3,291	78.1
<b>ESOL services groups</b>									
Never received	7,830	4,215	58.0	3,349	43.6	3,555	45.4	5,114	65.3
Past not current	2,240	735	34.3	612	27.7	753	33.6	1,070	47.8
Current recipient	531	31	6.9	61	12.1	88	16.6	108	20.3
<b>FARMS services groups</b>									
Never received	6,360	3,954	66.9	3,350	53.4	3,566	56.1	4,826	75.9
Past not current	1,303	445	36.1	291	22.7	317	24.3	577	44.3
Current recipient	2,938	582	21.5	381	13.4	513	17.5	889	30.3
<b>Special education services groups</b>									
Not current recipient	9,263	4,765	55.1	3,889	42.5	4,242	45.8	5,993	64.7
Current recipient	1,338	216	17.9	133	10.7	154	11.5	299	22.3

<sup>a</sup>750 students were missing scores.

<sup>b</sup>200 students were missing scores.

With respect to subgroups of students, slightly more female than male students performed at an advanced level on each measure. Among racial/ethnic groups, higher percentages of American Indian, Asian, and White students than Black or African American and Hispanic/Latino students achieved advanced levels on each measure. For each of the services groups, smaller percentages of current recipients than other groups performed at the advanced level on every measure.



**Grade 8 to Grade 12.** Among the group of 6,292 students who performed at an advanced level in Grade 8, over 5,700 of them (91%) were still enrolled in MCPS in 2012–2013 or had already graduated. The majority of these students still performed at an advanced level of achievement in Grade 12 (Table 3.2). Specifically, about two thirds (66%) performed at an advanced level on AP/IB exams, close to two thirds (64%) had SAT/ACT scores at the advanced level, and close to six out of ten (59%) completed a high school program at the advanced level.

Table 3.2  
Students Advanced in Grade 8 and Advanced in Grade 12 on Three Measures,  
by Demographic Characteristics and Service Receipt

Student characteristics and service receipt in Grade 8	Total <i>N</i> advanced in Grade 8	Advanced in Grade 12 on						Any measure (N = 5,708)	
		AP/IB exams (N = 5,622) <sup>a</sup>		SAT/ACT scores (N = 5,708)		High school program completion (N = 5,708)		<i>n</i>	%
		<i>n</i>	%	<i>n</i>	%	<i>n</i>	%		
All students	5,708	3,717	66.1	3,656	64.1	3,352	58.7	4,349	76.2
<b>Gender</b>									
Female	2,936	1,985	68.4	1,874	63.8	1,877	63.9	2,298	78.3
Male	2,772	1,732	63.7	1,782	64.3	1,475	53.2	2,051	74.0
<b>Race/ethnicity<sup>b</sup></b>									
Asian	1,177	921	79.3	891	75.7	886	75.3	1,030	87.5
Black or African American	826	332	40.2	272	32.9	256	31.0	409	49.5
Hispanic/Latino	695	302	43.5	201	28.9	209	30.1	2,552	85.3
White	2,993	2,155	73.7	2,286	76.4	1,994	66.6	350	50.4
<b>ESOL services groups</b>									
Never received	4,651	3,111	68.0	3,177	68.3	2,843	61.1	3,656	78.6
Past not current	984	564	57.8	452	45.9	472	48.0	643	65.3
Current recipient	73	42	60.9	27	37.0	37	50.7	50	68.5
<b>FARMS services groups</b>									
Never received	4,384	3,170	73.5	3,256	74.3	2,925	66.7	3,684	84.0
Past not current	546	251	47.0	207	37.9	203	37.2	308	56.4
Current recipient	778	296	38.2	193	24.8	224	28.8	357	45.9
<b>Special education services groups</b>									
Not current recipient	5,438	3,622	67.5	3,525	64.8	3,260	59.9	4,201	77.3
Current recipient	270	95	37.1	131	48.5	92	34.1	148	54.8

Note: Excludes students who withdrew prior to 2012–2013. Includes early graduates.

<sup>a</sup> 86 students were missing data.

<sup>b</sup> Excludes American Indians due to small sample size.

**More likely to stay at advanced.** Several subgroups of students were more likely to stay at the advanced level over time, from Grade 8 to the end of high school. A significantly higher percentage of female than male students performed at an advanced level on two measures: AP/IB exams (68% vs. 64%,  $\chi^2(1, N = 5,622) = 14.3, p < .01$ ) and high school program completion (64% vs. 53%,  $\chi^2(1, N = 5,708) = 67.6, p < .001$ ) in Grade 12.

On each Grade 12 measure, more students who were Asian or White stayed at an advanced level over time than Black or African American students or Hispanic/Latino students. For example, on AP/IB exams, 79% of Asian students and 74% of White students performed at an advanced level at the end of high school, compared to 40% of Black or African American students and 44% of Hispanic/Latino students.

Additional calculations (not reported in Table 3.2) were used to test for statistical significance in differences between racial/ethnic groups. Among students who were Asian or White, 75% stayed at an advanced level based on AP/IB exams compared to 42% of students who were Black or African American or Hispanic/Latino; this difference was statistically significant ( $\chi^2(1, N = 5,622) = 562.6, p < .001$ ). The differences between these groups were significant for the other two measures. Specifically, among students who were Asian, or White, 76% stayed at an advanced level over time based on SAT/ACT scores compared to 31% for Black or African American or Hispanic/Latino; this difference was statistically significant ( $\chi^2(1, N = 5,708) = 990.0, p < .001$ ). Likewise, 69% of students who were Asian or White stayed at an advanced level over time, based on high school program completion, compared to 31% of other racial/ethnic groups; this difference was statistically significant ( $\chi^2(1, N = 5,708) = 682.7, p < .001$ ).

Among ESOL service groups, a significantly higher percentage of Grade 8 students who had never received ESOL services stayed at an advanced level over time as measured by AP/IB exams (68%) than students who were past not current recipients (58%) and students who were current recipients (61%) ( $\chi^2(2, N = 5,622) = 37.5, p < .001$ ). This pattern of significant differences also occurred for SAT/ACT scores ( $\chi^2(2, N = 5,708) = 200.1, p < .001$ ), and high school program completion ( $\chi^2(2, N = 5,708) = 60.0, p < .001$ ).

Among FARMS service groups, significantly more Grade 8 students who had never received FARMS stayed at an advanced level over time as measured by AP/IB exams (74%) than students who were past not current recipients (47%) and students who were current recipients (38%) ( $\chi^2(2, N = 5,622) = 461.7, p < .001$ ). This pattern of significant differences was repeated for SAT/ACT scores ( $\chi^2(2, N = 5,708) = 881.2, p < .001$ ) and high school program completion ( $\chi^2(2, N = 5,708) = 507.8, p < .001$ ).

Lastly, with respect to special education services, significantly more Grade 8 students who were not currently receiving special education services than Grade 8 students who were currently receiving such services stayed at an advanced level over time on all three measures: AP/IB exams (68% vs. 37%,  $\chi^2(1, N = 5,622) = 100.7, p < .001$ ), SAT/ACT scores (65% vs. 49%,  $\chi^2(1, N = 5,708) = 29.7, p < .001$ ), and high school program completion (60% vs. 34%,  $\chi^2(1, N = 5,708) = 71.0, p < .001$ ).

In summary, several subgroups of students were more likely to stay at the advanced level from Grade 8 to the end of high school: females, Asian or White students, students who had never received ESOL, students who had never received FARMS, and non-recipients of special education services. In response to the finding that Black or African American and Hispanic/Latino students were less likely to continue at an advanced level at the end of high school, the rest of this study focused on those students.

## Question 2: Which Programs and Curricular Options Supported Continued Achievement by Black or African American and Hispanic/Latino students at an Advanced Level?

The sample for question 2 was smaller than that for question 1; it was limited to the 1,521 Black or African American and Hispanic/Latino students who were high achievers in Grade 8 in the 2008–2009 school year and who also completed Grade 12 in MCPS.

**Question 2a: Most likely to continue achievement at advanced levels in high school.** The first set of findings about programs or curricular options in which students were most likely to continue as high achievers concerns high school programs. For each of 11 high school programs, the percentage of program enrollees who performed at the advanced level at the end of high school is in Table 4.1. Note that two programs at Poolesville, Global Ecology (n=8) and Humanities (n=7), were combined to ensure a large enough size for analysis. The programs in which enrollees were most likely to continue as high achievers were: CAP at Montgomery Blair HS, IB at Richard Montgomery HS; Science, Mathematics, & Computer Science at Montgomery Blair HS and Poolesville HS; and Global Ecology or Humanities House at Poolesville HS. In these four programs, all or almost all of the enrollees continued as high achievers at the end of Grade 12.

Table 4.1

Proportion of Black or African American and Hispanic/Latino Students who Were High Achievers in Grade 8 and who Performed at the Advanced Level at the End of High School by High School Program

High school program	Total number	At advanced level at end of high school	
		<i>n</i>	%
CAP at Montgomery Blair HS	11	11	100.0
IB program at Richard Montgomery HS	17	17	100.0
Science, Mathematics, & Computer Science at Montgomery Blair HS and Poolesville HS	10	10	100.0
Global Ecology or Humanities House at Poolesville HS	15	14	93.3
Local IB programs	98	81	82.7
Leadership Training Institute at John F. Kennedy HS	9	7	77.8
Biomedical Magnet Program at Wheaton HS	20	11	55.0
Engineering Magnet Program at Wheaton HS	12	6	50.0
Technology at Thomas Edison High School of Technology	30	5	16.7

The second set of results about programs or curricular options in which students were most likely to continue as high achievers concerns signature programs, which are unique to one MCPS high school, and thus have few students. Therefore, the following four signature programs that each require AP courses were combined to ensure a large enough size for analysis: APEX Program at Walter Johnson High School (n=3), APPS at Clarksburg High School (n=6), Humanities & Arts (H&A) at Wootton High School (n=4), and PEAC Scholars at Col. Zadok Magruder High School (n=8). Although the two signature programs at Winston Churchill High School had only four enrollees, they were not combined with the others because they do not require AP courses. The number of enrollees in the Ulysses Program at Northwest HS was large enough that this signature program was analyzed by itself.

For each signature program, Table 4.2 shows the percentage of enrollees who performed at the advanced level at the end of high school. The programs in which enrollees were most likely to continue as high achievers were the group of four signature programs that require AP courses (APEX, APPS, H&A, PEAC) and the Ulysses Program at Northwest High School. In these signature programs, all of the enrollees performed at the advanced level at the end of Grade 12.

Table 4.2

Proportion of Black or African American and Hispanic/Latino High Achievers in Grade 8 who Performed at the Advanced Level at the End of High School by High School Signature Program

High school signature program	Total number	At advanced level at end of high school	
		<i>n</i>	%
Four programs that require AP courses (APEX, APPS, H&A, PEAC)	21	21	100.0
Two programs at Winston Churchill HS	4	4	100.0
Ulysses Program at Northwest HS	27	22	81.5

The third set of results about programs or curricular options in which students were most likely to continue as high achievers concerns curricular options, specifically enrollment in the following four types of courses that support advanced learning. Advanced-level courses are based upon previous achievement in a sequence of study. AP courses are those courses for which a College Board Advanced Placement examination exists. An Honors course includes curriculum adaptations for accelerated and enriched learning. IB courses are part of the IB curriculum; students at six high schools with the IB program can enroll in IB courses without enrolling in the full program.

Table 4.3 shows the percentage of enrollees in two or more semesters (i.e., equivalent to one year) of each type of course who performed at the advanced level at the end of high school. The curricular option in which enrollees were most likely to continue as high achievers was IB courses. Over two-thirds of the 237 students who completed two or more semesters of an IB course performed at the advanced level at the end of Grade 12, based on any measure.

Table 4.3

Proportion of Black or African American and Hispanic/Latino High Achievers in Grade 8 who Performed at the Advanced Level at the End of High School by Four Types of Courses (N = 1,521)

Type of course	# of enrollees in two or more semesters	At advanced level at end of high school	
		<i>n</i>	%
Advanced level	1,290	732	56.7
AP	1,254	744	59.3
Honors	1,478	746	50.5
IB	237	163	68.8

**Question 2b: Most impact.** Effect sizes were calculated to show if the impact of each program or curricular option on supporting high-achieving students to continue as high achievers was practically significant. Chi-square analyses were calculated to test whether enrollees in each program or option were statistically more likely than non-enrollees (see definitions in footnotes of Table 4.4) to continue as high achievers at the end of high school. Phi, an effect size, was

calculated for each chi-square and interpreted as follows: .10 for a small effect, .30 for a medium effect, .50 for a large effect. Chi-square analyses were repeated for each curricular option for a range of semesters (e.g., 4, 6, 8), because students could take more than one year of these courses. The enrollment level for each curricular option with the largest effect size (i.e., largest Phi) is presented in Table 4.4, along with the results for each program.

Table 4.4  
Proportion of Black or African American and Hispanic/Latino High Achievers in Grade 8 (N=1,521)  
who Performed at the Advanced Level at the End of High School  
by Enrollment in High School Programs and Curricular Options

High school program or curricular option	Enrollees			Non-enrollees			$\chi^2$ (df = 1)	Phi
	Total #	Advanced at end of high school <i>n</i>	%	Total #	Advanced at end of high school <i>n</i>	%		
Six or more semesters of AP courses	822	623	75.8	699 <sup>a</sup>	136	19.5	479.5***	.56
Six or more semesters of Advanced-level courses	721	530	73.5	800 <sup>a</sup>	229	28.6	305.6***	.45
Ulysses Signature Program at Northwest HS	27	22	81.5	62 <sup>b</sup>	22	35.5	15.9***	.42
Four or more semesters of IB courses	164	130	79.3	325 <sup>c</sup>	113	34.8	86.3***	.42
Local IB programs	98	81	82.7	329 <sup>d</sup>	122	37.1	62.9***	.38
Four signature programs that require AP courses (APEX, APPS, H&A, PEAC)	21	21	100.0	203 <sup>e</sup>	81	39.9	27.7***	.35
CAP at Montgomery Blair HS	11	11	100	425 <sup>f</sup>	172	40.5	15.6***	.19
Ten or more semesters of Honors courses	1,244	671	53.9	277 <sup>a</sup>	88	31.8	44.5***	.17
IB program at Richard Montgomery HS	17	17	100.0	1,504 <sup>a</sup>	689	45.8	19.8***	.11
Global Ecology or Humanities House at Poolesville HS	15	14	93.3	1,506 <sup>a</sup>	692	45.9	13.4***	.09
Science, Mathematics, & Computer Science at Montgomery Blair HS and Poolesville HS	10	10	100.0	1,511 <sup>a</sup>	696	46.1	11.6***	.09
Biomedical Magnet Program at Wheaton HS	20	11	55.0	416 <sup>f</sup>	187	45.0	0.8	.04
Engineering Magnet Program at Wheaton HS	12	6	50.0	424 <sup>f</sup>	177	41.7	0.3	.03
Technology at Thomas Edison HS	30	5	16.7	1,491 <sup>a</sup>	701	47.0	10.9***	-.09
Leadership Training Institute at John F. Kennedy HS	9	7	77.8	427 <sup>f</sup>	191	44.7	NA	NA
Two signature programs at Winston Churchill HS	4	4	100.0	26 <sup>g</sup>	16	61.5	NA	NA

Note. Programs and curricular options are not mutually exclusive.

<sup>a</sup> Includes all other students.

<sup>b</sup> Includes only students who attended Northwest HS in Grade 12.

<sup>c</sup> Includes only students who, in Grade 12, attended eight high schools that offer an IB program.

<sup>d</sup> Includes only students who, in Grade 12, attended seven high schools that offer a local IB program.

<sup>e</sup> Includes only students who, in Grade 12, attended Clarksburg, Magruder, Walter Johnson, or Wootton high school.

<sup>f</sup> Includes only students who attended a DCC middle school in Grade 8.

<sup>g</sup> Includes only students who attended Churchill HS in Grade 12.

NA= not available, because the sample size is too small for  $\chi^2$ .

\* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$

The option of enrolling in six or more semesters of AP courses had the largest Phi and thus the greatest impact on supporting high-achieving students to continue performing at an advanced level (Table 4.4 above). It was the only program or curricular option with a large effect size (Phi = .58), meaning that the observed relationship between enrollment in this curricular option and continued high achievement was practically significant and large. The curricular options or

programs with the next-largest impact had medium effect sizes (i.e.,  $\Phi \geq .30$ ) and also were practically significant. There were five options or programs with medium effect sizes: six or more semesters of Advanced-level courses, Ulysses Signature Program, four or more semesters of IB courses, local IB programs, and signature programs that require AP courses.

Note that several programs or curricular options had a Phi below .10, meaning that any difference between enrollees and non-enrollees was not practically significant. Also, note that the programs and curricular options examined were not mutually exclusive. For example, the option of six or more semesters of AP courses included students in the Ulysses Signature Program and those in the signature programs that required AP courses. Similarly, the option of four or more semesters of IB courses included students in local IB programs and those in the Richard Montgomery IB program.

**Summary.** Ten programs and curricular options (out of 19 analyzed) were identified as the most promising in supporting high-achieving, Grade 8 Black or African American and Hispanic/Latino students to continue achievement at an advanced level. They included four high school programs in which all or nearly all participants finished high school at an advanced level:

- CAP at Montgomery Blair HS
- Global Ecology or Humanities House at Poolesville HS
- IB at Richard Montgomery HS
- Science, Mathematics, & Computer Science at Montgomery Blair HS and Poolesville HS

The remaining six promising programs and curricular options were those with the greatest impact (i.e., the biggest effect size as measured by Phi) on supporting high-achieving students to continue as high achievers at the end of high school:

- Six or more semesters of Advanced-level courses
- Six or more semesters of AP courses
- Four or more semesters of IB courses
- Four signature programs that require AP courses (APEX, APPS, H&A, PEAC)
- Local IB programs at seven high schools
- Ulysses Signature Program at Northwest HS

### **Question 3: Characteristics of Programs and Curricular Options that Supported Continued Achievement at an Advanced Level**

This section provides more information on the 10 programs and curricular options for advanced learning that were identified in question 2 as the most promising in supporting high-achieving, Grade 8 Black or African American and Hispanic/Latino students to continue achievement at an advanced level.

*Descriptions.* Appendix B presents descriptions for each of the ten promising programs and curricular options.

*Common aspects.* All 10 of the promising programs or curricular options required enrolling in at least one of the four types of courses that support advanced learning, as follows:

- AP for five programs or options: CAP at Montgomery Blair HS, six or more semesters of AP courses, Global Ecology or Humanities House at Poolesville HS, the four signature programs that require AP courses (APEX, APPS, H&A, PEAC), Ulysses Signature Program at Northwest HS.
- IB for three programs or options: four or more semesters of IB courses, IB at Richard Montgomery HS, local IB programs.
- Advanced-level for two programs or options: six or more semesters of Advanced-level courses; Science, Mathematics, & Computer Science at Montgomery Blair HS and Poolesville HS.

Six of the ten promising programs and curricular options required applications:

- CAP at Montgomery Blair HS
- Four signature programs that require AP courses (APEX, APPS, H&A, PEAC)
- Global Ecology or Humanities House at Poolesville HS
- IB at Richard Montgomery HS
- Science, Mathematics, & Computer Science at Montgomery Blair HS and Poolesville HS
- Ulysses Signature Program at Northwest HS

Four or five of the promising programs and curricular options required a research project during the student's junior or senior year, specifically:

- CAP at Montgomery Blair HS
- IB at Richard Montgomery HS
- Local IB programs
- Two (i.e., APEX, H&A) of the four signature programs that require AP courses
- Ulysses Signature Program at Northwest HS

There was not a common length of time among the promising programs and options. The three curricular options could occur anytime during a student's high school years, both IB programs were focused on two years (junior and senior), and the remaining five programs involved all four years of high school.

## Discussion

Seven of the promising programs and curricular options involved enrollment in AP or IB courses, which is a pre-requisite to taking an AP or IB exam. Because scores on such exams were one of the three measures used to identify advanced achievement, there may be concerns due to the similarity between these definitions and the measure of success. Therefore, additional analysis that excluded performance on AP or IB exams was conducted; it used completing a rigorous high school program (as defined by MSDE) as the only measure of advanced achievement at the end of high school. It was used instead of ACT/SAT performance because it is more comprehensive.

The first analysis concerned the four programs in which all or almost all students continued as high achievers at the end of high school, when using any of three measures (Table 4.1 above). When using only one measure for high achievement (i.e., completion of a rigorous high school program), the percentage of enrollees who continued as high achievers remained at or close to 100% for CAP at Montgomery Blair HS and for Science, Mathematics, & Computer Science at Montgomery Blair HS and Poolesville HS (Table 5). However, for the other two programs, Global Ecology or Humanities House at Poolesville HS and IB at Richard Montgomery HS, the percentage of enrollees who were advanced at the end of high school declined to about 70% when using only one measure for advanced achievement at the end of high school (i.e., completion of a rigorous high school program), compared to more than 90%, when using the three measures of advanced achievement at the end of high school (i.e., SAT/ACT, AP exam/IB exam, or completion of a rigorous high school program).

Table 5  
Proportion of Black or African American and Hispanic/Latino High Achievers in Grade 8 (N=1,521)  
who Completed a Rigorous High School Program by Programs and Curricular Options

High school program or curricular option	Total #	Enrollees	
		Completed rigorous high school program	
		<i>n</i>	%
Science, Mathematics, & Computer Science at Montgomery Blair HS & Poolesville HS	10	10	100.0
CAP at Montgomery Blair HS	11	10	90.9
Four signature programs that require AP courses (APEX, APPS, H&A, PEAC)	21	17	81.0
Two signature programs at Winston Churchill HS	4	3	75.0
Global Ecology or Humanities House at Poolesville HS	15	11	73.3
IB program at Richard Montgomery HS	17	12	70.6
Leadership Training Institute at John F. Kennedy HS	9	6	66.7
Ulysses Signature Program at Northwest HS	27	15	55.6
Local IB programs	98	48	49.0
Six or more semesters of AP courses	1,037	445	42.9
Four or more semesters of IB courses	164	70	42.7
Six or more semesters of Advanced-level courses	721	355	49.2
Biomedical Magnet Program at Wheaton HS	20	8	40.0
Ten or more semesters of Honors courses	1,244	420	33.8
Engineering Magnet Program at Wheaton HS	12	4	33.3
Technology at Thomas Edison HS	30	2	6.7



The second analysis involved chi-square tests of whether enrollees in any of the programs or curricular options were statistically more likely than non-enrollees (see definitions in footnotes of Table 4) to complete a rigorous high school program. Based on the values of Phi from these analyses, there was no change in which six programs and curricular options had the most impact on supporting high achievers (Table 6). Although there were variations in the values of Phi for the top six programs or curricular options compared to the values from the analysis using all three measures for advanced achievement (see Table 4.4 above), the effect size for all six was medium.

Table 6

Proportion of Black or African American and Hispanic/Latino High Achievers in Grade 8 (N=1,521) who Completed a Rigorous High School Program by Enrollment in High School Programs and Curricular Options

High school program or curricular option	Enrollees			Non-enrollees			$\chi^2$ (df = 1)	Phi	Phi for advanced on at least one measure
	Total #	Completed rigorous high school program <i>n</i>	%	Total #	Completed rigorous high school program <i>n</i>	%			
Six or more semesters of AP courses	822	403	49.0	699 <sup>a</sup>	62	8.9	287.0***	.43	.56
Six or more semesters of Advanced-level courses	721	355	49.2	800 <sup>a</sup>	110	13.8	225.0***	.39	.45
Ulysses Program at Northwest HS	27	15	55.6	62 <sup>b</sup>	12	19.4	11.7***	.36	.42
Four or more semesters of IB courses	164	70	42.7	325 <sup>c</sup>	53	16.3	40.3***	.29	.42
Local IB programs	98	48	49.0	329 <sup>d</sup>	58	17.6	39.8***	.31	.38
Four signature programs that require AP courses (APEX, APPS, H&A, PEAC)	21	17	81.0	203 <sup>e</sup>	50	24.6	28.8***	.36	.35
Ten or more semesters of Honors courses	1,244	420	33.8	277 <sup>a</sup>	45	16.2	32.8***	.15	.17
IB program at Richard Montgomery HS	17	12	70.6	1,504 <sup>a</sup>	453	30.1	13.0***	.09	.11
Global Ecology or Humanities House at Poolesville HS	15	11	73.3	1,506 <sup>a</sup>	454	30.1	13.1***	.09	.09
Science, Mathematics, & Computer Science at Montgomery Blair HS and Poolesville HS	10	10	100.0	1,511 <sup>a</sup>	455	30.1	22.9***	.12	.09
Biomedical Magnet Program at Wheaton HS	20	8	40.0	416 <sup>f</sup>	117	28.1	1.3	.06	.04
Engineering Magnet Program at Wheaton HS	12	4	33.3	424 <sup>f</sup>	121	28.5	NA	NA	NA
Technology at Thomas Edison HS	30	2	6.7	1,491 <sup>a</sup>	463	31.1	8.2**	-.07	-.09
CAP at Montgomery Blair HS	11	10	90.9	425 <sup>f</sup>	115	27.1	NA	NA	NA
Leadership Training Institute at Kennedy HS	9	6	66.7	427 <sup>f</sup>	119	27.9	NA	NA	NA
Two signature programs at Churchill HS	4	3	75.0	26 <sup>g</sup>	10	38.5	NA	NA	NA

Note. Phi for advanced on any measure taken from Table 2.4 above.

<sup>a</sup> Includes all other students.

<sup>b</sup> Includes only students who attended Northwest HS in Grade 12.

<sup>c</sup> Includes only students who, in Grade 12, attended eight high schools that offer an IB program.

<sup>d</sup> Includes only students who, in Grade 12, attended seven high schools that offer a local IB program.

<sup>e</sup> Includes only students who, in Grade 12, attended Clarksburg, Magruder, Walter Johnson, or Wootton high school.

<sup>f</sup> Includes only students who attended a DCC middle school in Grade 8.

<sup>g</sup> Includes only students who attended Churchill HS in Grade 12.

NA= not available, because the sample size is too small for  $\chi^2$ .

\* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$

From this re-analysis, two programs, Global Ecology or Humanities House at Poolesville HS and IB at Richard Montgomery HS, appeared less promising for supporting continued high

achievement when performance on AP/IB exams was not used as a measure of high achievement, compared to the results when using any of three measures (including AP/IB exams). However, the students in IB at Richard Montgomery HS also were included in the curricular option of four or more semesters of IB courses; that curricular option continued to be one of those with the most impact on continued high achievement, even when excluding the AP/IB exams measure. In conclusion, with the exception of the two Houses at Poolesville, the identification of which programs and curricular options were the most promising was not an artifact of the similarity between the program's requirements (i.e., enrollment in AP or IB courses) and the measure of success (i.e., scores on AP or IB exams).

## Recommendations

The report's findings suggest the following recommendations to support continued achievement of Black or African American and Hispanic/Latino students:

- Starting in middle school, encourage Black or African American and Hispanic/Latino students who are performing at an advanced level to enroll in at least two, year-long Advanced-level, AP, or IB courses in high school. Augment course bulletins to indicate which courses are Advanced-level.
- Starting in middle school, encourage Black or African American and Hispanic/Latino students who are performing at an advanced level to enroll in IB programs or signature programs that require AP courses, at high schools with these programs.
- Consider establishing a signature program or modifying an existing signature program that targets advanced-level learners so that the program *requires* AP courses at the following high schools that do not have such a program and do not have an IB program:
  - James Hubert Blake
  - Winston Churchill
  - Damascus
  - Thomas Edison
  - Gaithersburg
  - Northwood
  - Paint Branch
  - Quince Orchard
  - Sherwood
  - Walt Whitman
- Consider expanding the availability of Advanced-level, AP, and IB courses and the size of IB and signature programs to support increased enrollment in these programs and curricular options by Black or African American and Hispanic/Latino students who performed at an advanced level in Grade 8.

The difficulties in identifying student participation in programs precluded identification of students outside of the study sample, of student participation in these programs as ninth graders, and of any students for certain programs. As a result, the study's analyses and findings were limited. The final recommendations on future research include one to avoid these difficulties:

- Develop a monitoring system to ensure that staff members at every school consistently and completely enter program codes for participants for every year of the program.
- Confirm the study's findings by replicating the research with a more recent class of MCPS graduates.

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## Appendix A

Table A  
 Statistics for Number of Semesters Completed by Black or African American and Hispanic/Latino High Achievers in Grade 8 (N = 1,521) for Four Types of Courses

	Semesters by the end of Grade 12			
	Advanced-level courses	AP courses	Honors courses	IB courses
Mean	7.0	6.6	15.0	1.7
Median	5.0	6.0	16.0	0.0
Standard deviation	7.6	5.3	5.8	5.3
Minimum	0	0	0	0
Maximum	44	24	32	31

## Appendix B

### Descriptions of Nine Promising Programs and Curricular Options that Supported Continued Achievement at an Advanced Level

#### Communication Arts Program (CAP) at Montgomery Blair HS

The Communication Arts Program is an application-only, four year, honors-level program with an interdisciplinary approach designed for students who wish to develop their intellectual, creative, and communication skills in the fields of media and the humanities. CAP is unique among secondary programs in MCPS because of the strong interdisciplinary connections among the humanities courses. These connections have led to an emphasis on student-centered, performance-based assessments, as each project reflects a variety of content areas. Once admitted to the program, students must successfully complete 13 CAP courses, maintain a minimum 2.75 GPA, and complete the CAP portfolio to graduate with the CAP certificate. Students follow a nine-period schedule which extends the school day until 3:20. (Description retrieved Oct. 3, 2016 [http://cap.mbhs.edu/newdocs/CAP%20Brochure %202016.pdf](http://cap.mbhs.edu/newdocs/CAP%20Brochure%202016.pdf).)

#### Six or more semesters of Advanced-level courses

Advanced-level courses are based upon previous achievement in a sequence of study; these courses are available in several content areas, including information technology/computer science, foreign languages, mathematics, and science.

#### Six or more semesters of AP courses

AP courses are those courses for which a College Board Advanced Placement examination exists.

#### Four or more semesters of IB courses

IB courses are offered as part of the IB program (see description below).

#### Four signature programs that require AP courses (APEX, APPS, H&A, PEAC)

1) The APEX Scholars program [at Walter Johnson HS] is designed as a four year course of study through which a select group of students follows a comprehensive curriculum combining accelerated honors level and intensive advanced placement level course work. The course of study provides students with a broad, general background in many academic areas at levels appropriate to highly academically gifted and motivated learners. (Description retrieved Aug. 25, 2016 [http://www.montgomeryschoolsmd.org/schools/wjhs/programs/apex/program\\_info.aspx](http://www.montgomeryschoolsmd.org/schools/wjhs/programs/apex/program_info.aspx).)

2) The APPS Program is designed as a four year course of study through which students follow a comprehensive curriculum combining honors level and advanced placement level course work. Students accepted into the program will follow a rigorous course of study designed to challenge the highly motivated learner. Students will receive structured support and skill refinement through their honors and advanced placement courses as well as through periodic lectures and seminars held at school. The program is designed to offer students flexibility in their schedules as they progress through their four years of study and allow them to pursue individual educational goals while at Clarksburg High School. (Description retrieved Sept. 8,

2016 <http://www.montgomeryschoolsmd.org/curriculum/specialprograms/high/signatures.aspx?id=141241>.)

3) The Humanities and Arts (H&A) Signature Program ...[at Wootton HS] is designed for students who are passionate about literature, film, history, languages, art, and/or performance. The students form a cohort in the 9th-10th grades through special enriched sections of English and Social Studies, which include special field trips, speakers, and artists-in-residence workshops. Students select a specific but flexible course of study with the Humanities or Arts Focus, and also complete an Off-Campus Experience and the Senior Independent Project. By the end of the program, students have polished oral presentation skills and are able to complete the high-level academic research and writing expected by universities. (Description retrieved Sept. 8, 2016 <http://www.montgomeryschoolsmd.org/curriculum/specialprograms/high/signatures.aspx?id=141265>)

4) PEAC Scholars [at Col. Zadok Magruder HS] PEAC is an inter-disciplinary, four-year college-preparatory cohort. Its focus is on independent learning and the development of sophisticated written and oral communication skills with an emphasis on critical thinking. Designed for the highly able student, PEAC Scholars offers accelerated courses that are only available to those accepted into the program. (Description retrieved Aug. 25, 2016 <http://www.montgomeryschoolsmd.org/schools/magruderhs/peac/>.)

#### Global Ecology or Humanities House at Poolesville HS

The Global Ecology House provides students with the knowledge and understanding of the science and cultural, social, political, economic, and technological conditions that affect the quality of life on our planet. Students will get a broad background of ecological information from which they may pursue a variety of environmental perspectives. The program also offers a unique computer-assisted approach to the study of environmental science and social studies, including networking with students and schools, locally and around the globe. Students will be challenged to develop a global ecological perspective as they investigate historical and current issues related to the earth's natural resources. (Description retrieved Sept. 8, 2016 <http://www.montgomeryschoolsmd.org/curriculum/specialprograms/high/magnet-ecology.aspx>.)

Humanities House students will pursue a rigorous humanities curricula with an interdisciplinary connection among English, social studies, communications, and fine arts. Humanities students will be able to integrate oral and written communication skills with state-of-the-art visual media. (Description retrieved Sept. 8, 2016 <http://www.montgomeryschoolsmd.org/curriculum/specialprograms/high/magnet-humanities.aspx>.)

#### IB at Richard Montgomery HS and Local IB programs at seven high schools

The International Baccalaureate Diploma Program is a demanding two-year international program that meets the needs of highly motivated Grade 11 and 12 students and leads to a qualification that is recognized by leading universities around the world. To earn an IB diploma, students must take a challenging liberal arts course of studies and pass examinations in six academic subjects. In addition, students are required to take the Theory of Knowledge (TOK) course that investigates the nature of knowledge in various disciplines; participate in



Creativity, Action, Service (CAS) to achieve eight learning outcomes, undertake original research, and write an Extended Essay of 4,000 words. Students successfully completing the program earn a MCPS diploma and a Montgomery County Certificate of Merit, in addition to the internationally recognized IB diploma. (Description retrieved Aug. 25, 2016 <http://www.montgomeryschoolsmd.org/curriculum/specialprograms/high/ib.aspx>.)

#### Science, Mathematics, & Computer Science at Montgomery Blair HS and Poolesville HS

The Science, Mathematics, Computer Science Magnet program is designed to offer accelerated instruction in the areas of math, science, and computer science for highly motivated and able students. It is a rigorous program that emphasizes the development of problem-solving skills, critical thinking, and the pursuit of both independent and collaborative research projects. Students will have unique opportunities to partner with mentors from many local and national businesses and research organizations. (Description retrieved Sept. 8, 2016 <http://www.montgomeryschoolsmd.org/curriculum/specialprograms/high/magnet-science.aspx>.)

#### Ulysses Signature Program at Northwest HS

The Ulysses Program is a four-year program that encourages student-initiated explorations in areas of strong interest. Research skills are emphasized through signature sections of English, history, and science. All course offerings are at the honors or AP level; interdisciplinary connections are encouraged. Through independent and collaborative research and technology-infused presentations, students experience various modes of inquiry while learning to use their minds well. Ulysses students study, create, and achieve in an intellectual and nurturing community of learners. (Description retrieved Aug. 25, 2016 <http://northwesths-montgomeryschoolsmd.libguides.com/Ulysses>.)