Policy Information Report

Access to Success:

Patterns of Advanced Placement Participation in U.S. High Schools

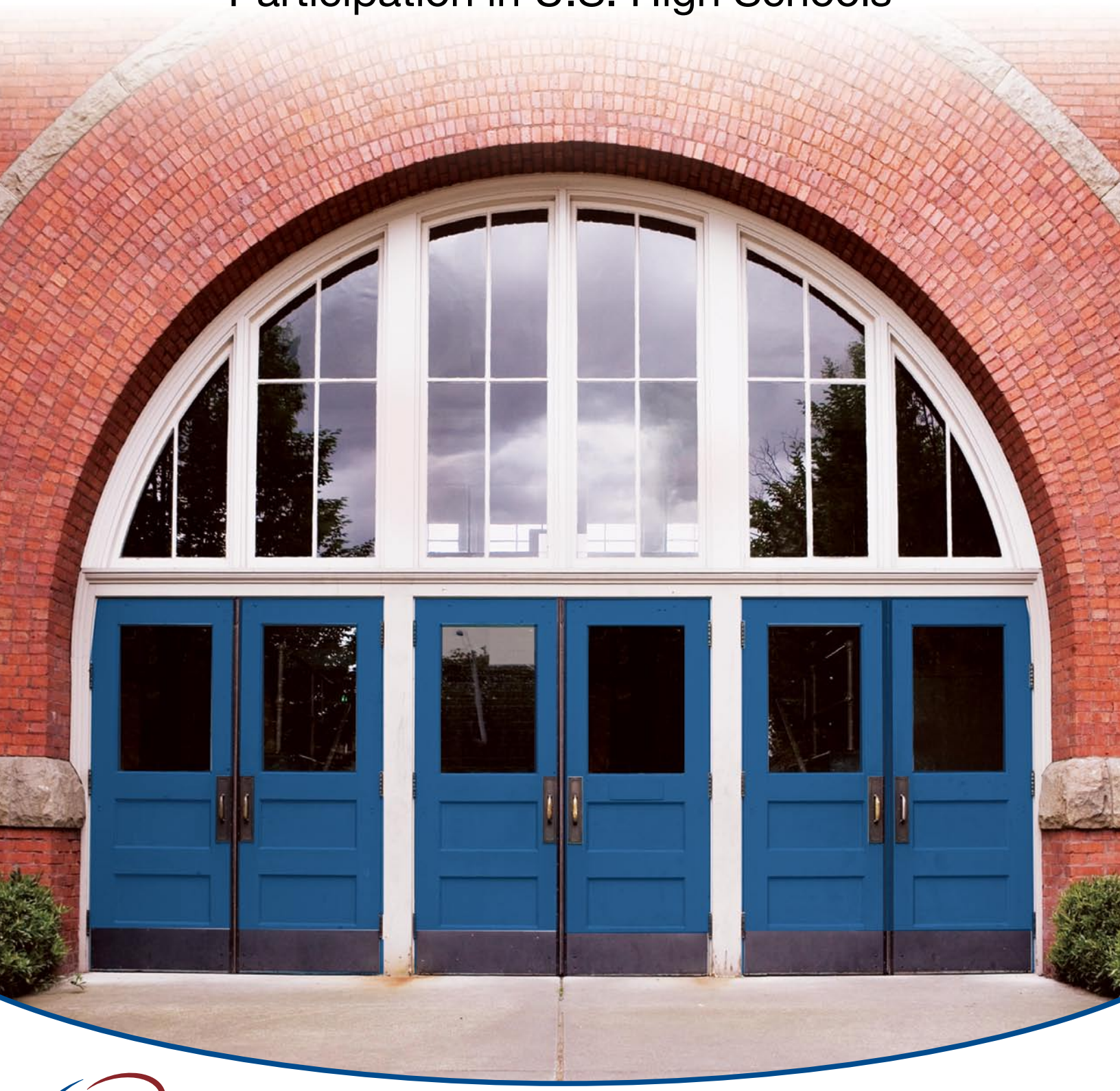

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Table of Contents

Preface

As part of the movement for more rigorous high school curricula, national and state leaders, along with education policymakers and organizations like the College Board, have advocated for expanded access to Advanced Placement Program® (AP®) courses. The need for more rigorous coursework like the AP program is particularly acute for underrepresented students, including students from low-income families and students from racial/ethnic minorities. The AP program and other rigorous courses are often considered to be essential for students, regardless of social class and race/ethnicity, who are aiming to attend selective colleges and universities. But for many underrepresented students attending less selective institutions, such courses may be the best, if not the only, opportunity to participate in meaningful and productive high school curricula.

The College Board, the sponsor of the AP program, provides annual, comprehensive reports on AP program participation and performance at the national and state levels and for different racial/ethnic groups. These reports show steady growth in the program, although students in the largest racial/ethnic minority groups continue to participate at much lower rates.

To obtain a different view of patterns of access to the AP program, Handwerk, Tognatta, Coley, and Gitomer used a novel approach to examining these data. They merged College Board data on AP program participation with a national database that contains extensive information on all U.S. public high schools. By matching the students with their high schools, Handwerk and his colleagues were able to view AP program participation and performance in the context of important high school characteristics, including such factors as school size, locale, and socioeconomic status. This unique view provides a snapshot of AP program activity in the 2003-04 school year.

The view the authors provide is more sobering than the one provided by typical data analyses. Although most students attend a high school at which the AP program is available, few students actually take an AP exam even after taking an AP course, and only a fraction of those who do take a test score high enough to qualify for college credit or placement in the colleges and universities that offer such opportunities. Patterns of participation for low-income and underrepresented minority students and for students attending small, rural high schools are particularly troubling. As national and state leaders emphasize the need to expand opportunities for more students to participate in advanced coursework, this report creates a better understanding of the challenges that remain in promoting access to such opportunities for all students.

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Providing high school students access to advanced coursework has long been considered an important means of preparing students for success after high school. The College Board's Advanced Placement Program (AP) is among the largest of several programs providing advanced curricula to high school students today. For many years, the College Board has generated extensive data on AP program participation and performance at national and state levels and has provided these data for different racial/ethnic groups of students. This study offers a broader and deeper perspective by merging the College Board's AP program data for the 2003-2004 school year with data from the U.S. Department of Education for all U.S. public high schools. Thus, for the first time we can answer the following three questions about students in grades 9 through 12:

1. **What is the availability of the AP program in the nation's public high schools?** What typically has been reported is the number of schools offering the AP program. This report examines how AP offerings differ across public schools that share important dimensions as determined by cluster analysis. This report also examines the intensity of AP offerings in these public schools — that is, the breadth of their AP offerings.
2. **How many students participate in AP?** What typically have been reported are overall counts of students and counts of students disaggregated by subgroups. This report looks at participation patterns in public schools with different socioeconomic, racial/ethnic, and geographic characteristics.
3. **How many students are eligible for advanced placement or college credit?** What typically have been reported are overall AP grade distributions by subject and student subgroups. This report examines AP grade information for public schools with different socioeconomic, racial/ethnic, and geographic characteristics.

We took this approach because examining data on overall average rates of participation and performance in the AP program can mask important differences in the availability of educational opportunity to students attending different types of schools. The data in this report allow a richer and more detailed understanding of how different types of public schools and students differ in their access to, and performance in, the AP program.[1]

We present brief highlights of the study's findings below. In the body of the report, we show how access to the AP program, participation in the AP program, and performance in the AP program were defined in this study and the methods (cluster analysis) used to group American high schools into clusters based on their similarities.

What is the AP program availability across the nation's public high schools? *High schools were defined as "offering" the AP program if at least one student in that high school took an AP examination in the 2003-2004 school year.*

- Fifty-eight percent of U.S. public high schools, enrolling 85 percent of all students, offered some type of AP program. For the purpose of this paper, schools' AP offerings were categorized on the basis of the intensity of their AP offerings — those offering at least one AP mathematics exam, at least one AP science exam, and at least one AP English exam were defined as "High AP" schools. Schools that offered at least one AP exam but did not meet the "High AP" thr eshold were defined as "Low AP" schools. Twenty-four percent of high schools offered at least one AP exam ("Low AP" schools) while 34 percent offered a fuller complement of exams ("High AP" schools).
- There is unequal access to the AP program among racial/ethnic groups. While 94 percent of Asian American students attend public schools where at least one student is taking an AP exam, only 81 percent of African American students attend such schools. Further, when the AP program is available, African American students are more likely to attend schools classified as "Low AP" and are the least likely to attend "High AP" schools.

[1] To accomplish this, this study uses a methodology that results in different AP participation rates than those reported by the College Board's *Advanced Placement Report to the Nation*. This report provides a snapshot of AP participation within one calendar year, while the College Board data report on students' AP participation accumulated over all of their high school years. The result of this difference is that the present study reports less AP participation than reported in the College Board's annual AP report since some of the high school underclassmen who are not identified as AP participants may ultimately participate in the program by the time they graduate. The College Board's *Advanced Placement Report to the Nation* is available at www.collegeboard.com/prod_downloads/about/news_info/ap/2005/ap-report-nation.pdf. See pages 11 to 14 of this report for a discussion of the data used in this study.

- Low-income students were less likely than other students to attend public schools offering the AP program (81 percent vs. 88 percent). When they did attend AP schools, the program was more likely to offer limited AP course options.
- Large, suburban public schools with predominantly nonminority populations were the most likely to have the AP program available. Small, rural, low-income public schools in the Midwest were the least likely to have the AP program available.

How many students participate in the AP program? *A student is defined as participating in AP if he or she took any AP exam during the 2003-2004 year regardless of AP grade.*

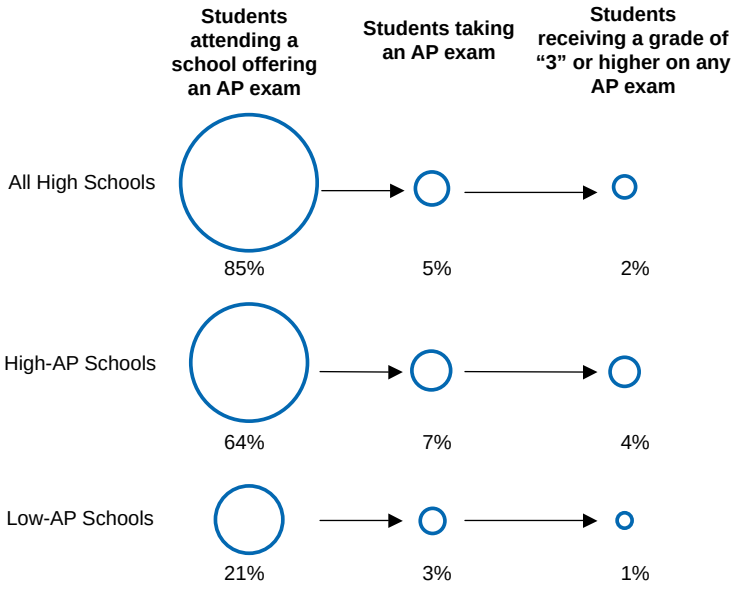
- Overall, a median of 5 percent of public high school students who attended schools that provided the AP program participated in the AP program.
- Participation across clusters of high schools ranges from 5 percent to 8 percent in "High AP" schools to less than 3 percent in "Low AP" schools.
- In public schools offering the AP program as defined in this study, females were more likely than males to participate in the program (6.1 percent vs. 4.3 percent). This finding held across all school clusters and for both "High AP" and "Low AP" schools.
- There were major racial/ethnic differences in participation in the AP program — 10.3 percent of Asian American, 5.3 percent of White, 2.4 percent of Hispanic, and 0.5 percent of African American students took an AP exam.
- Less than 1 percent of low-income students (as measured by eligibility for free and reduced price lunch) took an AP exam in schools that offered AP exams.

How many students are eligible for advanced placement or college credit? *A student is defined as "eligible for advanced placement or college credit" if he or she received a grade of 3 or higher on any AP exam during the 2003-2004 year.*

- Overall, a median of 2.4 percent of public high school students earned a grade of 3 or better on at least one AP exam. For females, the rate was 2.7 percent, compared with 2.1 percent for males.
- A grade of 3 or higher ranges from a median of 4 percent of Asian American students, to 2.8 percent of White students, to 0.6 percent of Hispanic students. The median percentage for African American students is zero.
- Eligibility for advanced placement or college credit is related to the intensity of the AP program in the school. In "High AP" schools, a median of 4 percent of students achieve a grade of 3 or higher and thus are eligible for AP credit, compared with less than 1 percent in "Low AP" schools.
- Eligibility for advanced placement or college credit is also related to income status. While 3 percent of non-low-income students received a grade of 3 or higher in an AP exam, the median percentage for low-income students was zero.

Figure 1

Overall Summary of Public High School Students' Exposure to the AP Program



Sources: College Board 2004 AP Administration File and U.S. Department of Education Common Core of Data, 2003-2004 Public Elementary and Secondary School Universe Survey Data analyzed by Educational Testing Service.

Conclusion

As shown in the figure above, while 85 percent of public high school students attend schools that offer AP exams, few students participate in the program by taking exams, and even fewer score high enough to earn college credit or placement.

- Cluster analysis of schools revealed that clusters comprising the larger schools in more densely populated areas were more likely to offer AP exams than smaller, more rural school clusters.

- Across all clusters, public high schools are similar with regard to patterns of AP exam participation and grades earned across all racial/ethnic categories. Even in schools that have high overall participation rates, African American students are much less likely to participate in the program by taking an exam than are students in other racial/ethnic groups.
- Low-income and underrepresented minority students consistently lag behind their peers in AP exam participation and performance.[2]

Implications

- Although the data show that the AP program is available in most public high schools, this report identifies major opportunities for expanding the program.
- For more students to reap the benefits of AP program participation by taking and doing well on the exam in addition to taking the course, schools need to do more to broaden their programs and create an "AP culture" within their schools. Underrepresented students in particular are more likely to participate in the AP program in schools that offer more AP courses.
- Some segments of the high school population may especially benefit from efforts to expand the breadth and depth of advanced academic coursework. These include small, rural, low-income schools that are less likely than other types of high schools to participate in the AP program, and underrepresented minority and low-income students who are particularly underserved by the program.
- The availability of the AP program in a school is a necessary but insufficient factor in promoting student participation. Even in schools offering the program (where at least one student takes an AP exam) and among those classified as "High AP," few students are actually taking the AP exam.

The "Conclusions" section of this report provides recommendations for further research.

[2] These low rates of AP program participation, particularly among low-income and underrepresented minority group students, are generally consistent with Clifford Adelman's unpublished analysis of data from NELS:88/2000 based on both high school and postsecondary transcripts for students who were high school seniors in 1992. Adelman reports no AP participation for 92 percent of all high schools students, 91 percent of White students, 97 percent of African American students, 97 percent of Latino students, and 79 percent of Asian students. Rates of participation ranged from 4 percent in the lowest third of family income to 14 percent in the highest third. Among socioeconomic status quintiles, participation ranged from 2 percent in the lowest quintile to 20 percent in the highest quintile. Source: Personal communication, May 31, 2007.

Providing high school students with access to advanced coursework has long been held as an important means of preparing students for academic and professional success after high school. In 1983, the landmark report *A Nation at Risk* articulated the country's weakening "preeminence in commerce, industry, science and technological innovation," and inferred that a strengthening of high school instruction was required.[3]

More recently, a 1999 U.S. Department of Education report, *Answers in the Tool Box*, supported the view that college readiness and completion depend most on the "quality and intensity of one's high school curriculum."[4] That study was replicated in 2006 in *The Toolbox Revisited,* which reaffirmed the finding that the academic intensity of the high school curriculum is the most significant contributor to college completion, and that AP intensity is most clearly indicated by successful performance on AP exams.[5]

In 2007, the National Academy of Sciences issued a report that addresses several critical challenges that the United States faces in the global marketplace and in science and technology. One of the report's recommendations calls for widening the pipeline for students who are prepared to enter higher education by providing opportunities and incentives for more students to take advanced coursework in high school.[6]

Though research has underscored the value of academic rigor to predict future success time and again, research also shows that the high school educational experience is often different among racial/ethnic groups. Newly collected data from the National Assessment of Educational Progress (NAEP) provides a picture of this differential high school experience for the high school class of 2005. The NAEP data revealed some progress as well as some lingering gaps in narrowing the differences in academic experiences among students of different racial/ethnic backgrounds. Since 1990, African American high school graduates have closed a six-point gap with White graduates in the percent completing at least a midlevel curriculum —- by 2005 there was no significant difference between White and Black graduates. However, the corresponding White-Hispanic gap in 2005 was not significantly different from that in 1990. In addition, African American and Hispanic graduates were less likely than their White classmates to have completed calculus or advanced science courses. [7]

The U.S. Department of Education's *Condition of Education 2007*[8] highlights similar gaps in patterns of AP course taking and performance by race/ethnicity. The report examines the trend in AP mathematics, science, English, and foreign language courses. It finds that although the total number of students taking AP exams more than doubled between 1997 and 2005, there was a decline in the percent of students earning a qualifying grade of 3 or above (from 65 percent to 59 percent). In the same period, the participation of minority students increased from 27 percent to 33 percent. The report also notes that there was a decline in the average performance of minority group students, while the average grades of White and Asian students remained relatively constant. The report suggests that in the past few years, "female students have been more likely than males to complete some advanced science coursework."

Research studies show that academic placement in secondary school influences achievement and the likelihood of high school graduation for students of different socioeconomic backgrounds.[9] Standardized test scores and grades in English and mathematics in middle school have both been shown to determine track placement in high school. Researchers also have found that student placement during the middle school years is directly related to tracking decisions made in high school. And studies have shown that students' "social origins," such as soecioeconomic status and race/ethnicity, influence their track placement and subsequent academic achievement.[10] Therefore, when schools exclude students with certain background

[3] National Commission on Excellence in Education, *A Nation at Risk: The Imperative for Educational Reform*, Washington, D.C., April 1983.
[4] Clifford Adelman, *Answers in the Tool Box: Academic Intensity, Attendance Patterns, and Bachelor's Degree Attainment*, U.S. Department of Education, Washington, D.C., June 1999.
[5] Clifford Adelman, *The Tool Box Revisited: Paths to Completion from High School Through College*, U.S. Department of Education, Washington, D.C., February 2006.
[6] National Academy of Sciences, *Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future*, Committee on Science, Engineering, and Public Policy, 2007.
[7] C. Shettle et al., *The Nation's Report Card: America's High School Graduates*, U.S. Department of Education, National Center for Education Statistics, Washington, D.C., 2007. Midlevel curriculum is defined as meeting a standard curriculum (at least four credits of English and three each in social studies, mathematics, and science) plus completion of geometry and algebra II; at least two courses in biology, chemistry, and physics; and at least one credit of a foreign language.
[8] *High School Course Taking – Findings from The Condition of Education 2007,* National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education, NCES 2007-065. Report retrieved on September 18, 2007 from http://nces.ed.gov/pubs2007/2007065.pdf.
[9] Adam Gamoran and Robert D. Mare, "Secondary School Tracking and Educational Inequality: Compensation, Reinforcement, or Neutrality," *American Journal of Sociology*, v94 n5, pp 1146-83; March 5, 1989.
[10] Maureen T. Hallinan, "School Differences in Tracking Effects on Achievement," *Social Forces,* 72 (3), March 1994, pp 799-820.

characteristics from academically rigorous coursework, by way of academic placement or access to an AP course, they are inadvertently worsening the achievement and graduation gaps among students of different backgrounds.

So, while there is consensus on the importance of a rigorous high school curriculum, questions remain about the extent to which all students have access to a strong high school program.

The Advanced Placement Program

In recognition of the strong evidence that an academically enriched high school experience contributes to college readiness and college graduation, several programs to provide advanced curriculum to high school students exist today. For example, high schools and two- and four-year colleges collaborate in dual enrollment courses, and the International Baccalaureate® Programme (IB) provides university preparation. This report will focus exclusively on the largest of these programs, the College Board's Advanced Placement Program (AP).[11]

The AP program is a collaborative effort between secondary and postsecondary institutions that provides students opportunities to take freshman-level courses while still in high school. These courses are designed by committees of college faculty and experienced AP teachers based on a set of publicly available standards with an end-of-course assessment. Regular surveys and research efforts are designed to ensure that the course content is congruent with the curriculum and the best practices of corresponding college courses.[12] Apart from helping to create the challenging course content, AP teachers participate in professional development workshops intended to enhance their students' learning experiences. The AP exam typically includes a series of multiple-choice questions and an essay section, scored electronically and by human readers, respectively. Performance on the assessment may imply eligibility to receive college credit and/or placement from the institution of the student's choice. Students are graded on a five-point scale, in which a score of 5 reflects the highest level of mastery of the AP course content. A grade of 3 on an AP exam often qualifies a student to receive course credit or advanced placement from participating institutions, though the decision to award credit varies across institutions and subjects within institutions.

Table 1 lists the 34 AP examinations across six discipline areas available in 2004 (the basis for this study). Currently, the College Board develops and publishes guidelines for 37 courses in 20 subject areas.

Table 1

AP Exams by Disciplinary Area, 2004

Discipline Area	AP Exams
Arts	Music Theory; Studio Art: 2-D Design, Studio Art: 3-D Design, Studio Art: Drawing
English	English Language and Composition, English Literature and Composition
Foreign Languages	French Language, French Literature, German Language, Latin Literature, Latin: Virgil, Spanish Language, Spanish Literature
Math	Calculus AB, Calculus BC, Statistics
Science/Computer Science	Biology, Chemistry, Computer Science A, Computer Science AB, Environmental Science, Physics B, Physics C – Electricity and Magnetism, Physics C – Mechanics
Social Sciences	Art History, European History, Government and Politics: Comparative, Government and Politics: United States, Human Geography, Macroeconomics, Microeconomics, Psychology, United States History, World History

Source: The College Board.

[11] Recent figures indicate that AP exams were administered in over 15,000 U.S. high schools (http://www.collegeboard.com/prod_downloads/about/news_info/ap/2007/2007_ap-report-nation.pdf) while IB's Diploma Programme is offered in approximately 500 U.S. high schools (http://www.ibo.org/facts/schoolstats/progsbycountry.cfm). "Overall, approximately 813,000 high school students took college-level courses through postsecondary institutions, either within or outside of dual enrollment programs, during the 2002-03 12-month academic year. This number represents about 5 percent of all high school students." (http://nces.ed.gov/pubs2005/2005008.pdf).

[12] In 2005, the College Board announced an audit of AP courses involving a review by college professors of individual teachers' syllabi in the 37 subject areas covered in AP classes.

AP Performance and Academic Success

While not all research has been clear as to the benefits of the AP program, numerous studies have explored the link between success in the AP program and later success in higher education. One study examined the relationship between AP participation and performance on the one hand and college graduation rates on the other. Like Adelman's findings described earlier, the study shows that students who take AP courses and earn AP grades of 3 or higher are more likely to graduate from college than students who take the course but do not take the exam, who in turn are more likely to graduate than students who do not participate in an AP course at all.[13] Another study found that the percentage of students in a high school with at least one student who scored an AP grade of 3 or better was a much stronger predictor of college graduation rates than was the percent of students taking AP courses but not passing the exams.[14] Research conducted by professors at the University of Austin, Texas, and the College Board reported that students who earned credit for their AP scores tend to do at least as well — and sometimes better — than their peers in subsequent college courses. [15] However, other researchers claim that studies showing positive effects of the AP program — specifically its high predictive validity of college grades and retention — are more a result of students' non-AP coursework in math and science.[16]

Efforts to Boost Participation

As the diversity of the K-12 school population increases, it is important to examine the distribution of student access to the most rigorous high school programs. This is especially so if the segments of the population that are growing fastest (namely, "under-represented" or non-White and non-Asian minorities) are left out from valuable and rigorous coursework.[17]

Concerns regarding the participation and performance of low-income and underrepresented students in the AP program,[18] and in advanced coursework in general, have prompted various stakeholders to invest in initiatives to increase participation in the AP program, and improve performance on AP exams. The College Board has worked at increasing access since the early days of the AP program.[19] The most popular, and probably the flagship program in its pool of access initiatives, is the AP Test Fee Program, in which students meeting the "financial need" criterion are given discounted test fees.

The increase in the AP participation of economically disadvantaged and minority students over the past decade may also be attributed to the Advanced Placement Incentive Program (APIP) and the Advanced Placement Test Fee Grant program sanctioned by the U.S. Department of Education. The recipients of these monetary awards (national, state, or local education agencies) must meet eligibility requirements of serving students in schools where at least 40 percent of the student body is low income.

States and local districts offer their own AP program strategies: test-fee reduction policies; start-up grants; teacher professional development; and incentives for student and teacher performance. Many of the policies are targeted directly at specific disadvantaged groups, often low-SES and/or underrepresented minority students.[20]

The Growth in the AP Program and Equity of Access

We now explore summary national data that report the substantial growth in the AP program across the United States, along with data on participation in the AP program among students of different racial/ethnic groups.

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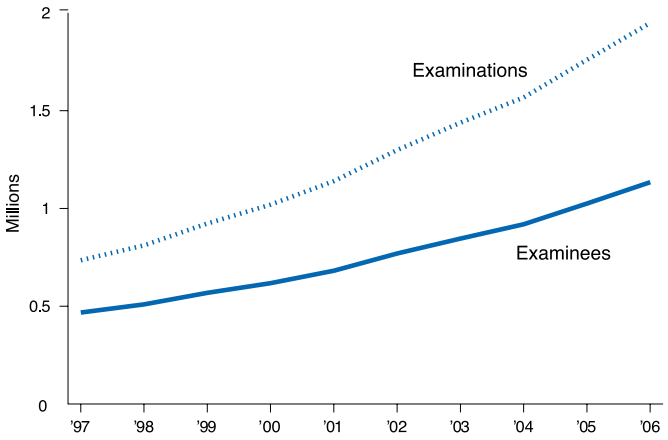
[13] Chris Dougherty, Lynn Mellor, and Shuling Jian, *Orange Juice or Orange Drink? Ensuring That "Advanced Courses" Live Up to Their Labels*, NCEA Policy Brief No. 1, Austin, TX: National Center for Educational Accountability, 2006.
[14] Saul Geiser and Veronica Santilices, *The Role of Advanced Placement and Honors Courses in College Admissions,* Paper CSHE-4-04, Center for Studies in Higher Education, 2004. Retrieved 12/20/2006 from http://repositories.cdlib.org/cshe/CSHE-4-04/.
[15] Barbara G. Dodd et al., *An Investigation of Validity of AP Grades of 3 and a Comparison of AP and Non-AP Student Groups*, College Board Research Report No. 2002-9, New York: The College Board, 2002. For more AP research published by the College Board see: http://apcentral.collegeboard.com/apc/public/colleges/research/index.html.
[16] Kristin Klopfenstein and M. Kathleen Thomas, *The Link Between College Success, Advanced Placement Experience and College Success*, unpublished paper, retrieved June 21, 2007 from http://www.utdallas.edu/research/tsp/pdfpapers/newpaper1b.pdf.
[17] U.S. Census Bureau, *U.S. Interim Projections by Age, Sex, Race, and Hispanic Origin*, http://www.census.gov/ipc/www/usinterimproj/.
[18] Sam Dillon, "Advanced Placement Tests Are Leaving Some Behind," *The New York Times*, February 7, 2007. Retrieved on February 7, 2007 from http://www.nytimes.com/2007/02/07/education/07ap.html.
[19] For more information on College Board AP Equity programs see: http://apcentral.collegeboard.com/apc/public/program/initiatives/2200html.
[20] The Education Commission of the States provides an exhaustive list of current policies across the 50-states designed to increase AP participation and performance. http://www.ecs.org/ecsmain.asp?page=/html/statesTerritories/state_map.htm.

Figure 1 shows the rise over the past several years not only in the number of AP exams taken in U.S. public schools, but also the growth in the number of examinees. Between 1997 and 2006, the number of examinees increased by 142 percent and the number of exams taken increased by 165 percent. The divergence between the lines in Figure 1 reflects both an increase in the number of examinees and in the number who take more than one AP exam.

Figure 1

Trends in the Number of AP Examinations and Examinees, U.S. Public Schools



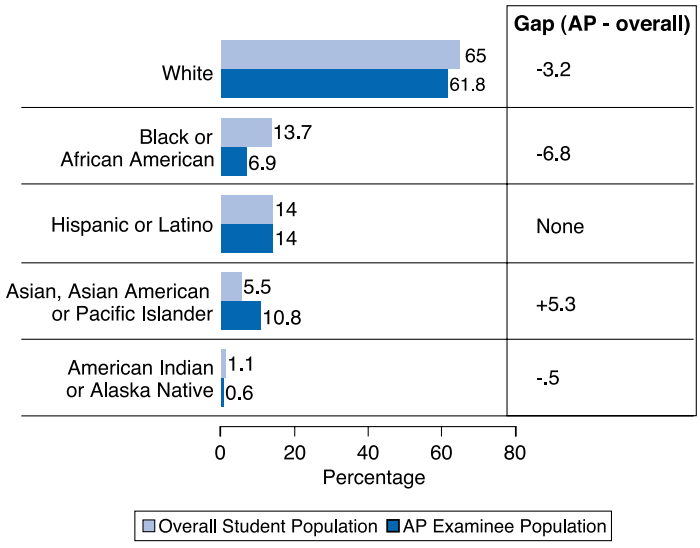
Source: College Board AP Summary Reports.

Figure 2 compares the relative racial/ethnic proportional composition of the entire cohort of graduating seniors in U.S. public high schools with the proportional composition of the participating AP population for that same group. The figure also shows the gap, expressed as the difference, in percentage points, between the proportions of the entire graduating population and the AP examinee population. Of course, the fact that these groups also have different high school graduation rates means that these differences really represent a lower-bound estimate of the gap in AP exam taking.

Recent data show that African American, White, and American Indian or Alaska Native students are underrepresented in the AP program. For example, while African American high school seniors comprised almost 14 percent of all public high school seniors, they comprise only about 7 percent of the AP examinee population. Hispanic or Latino students are evenly represented among both populations, at 14 percent. The only group that is overrepresented in the AP program relative to their share of the high school senior population consists of individuals who categorize themselves as Asian or Pacific Islander. This highly diverse group surpassed its representation in the high school senior population by 5 percentage points.

Figure 2

Percentage of AP Examinees Compared to Graduating Senior Population, U.S. Public Schools, 2006



Source: College Board AP Summary Reports.

This report provides a national picture of the AP program as it exists in the nation's high schools. We present the report against the backdrop of a national focus on curricular intensity, continued expansion of the AP program over the last several years, and substantial funding for AP program expansion at multiple levels.

Historically, extensive national and state data have been available from the College Board on student participation in the AP program. The College Board provides AP grade distributions for each examination for racial/ethnic groups and for males and females. These data, however, are not linked to the total universe of high schools that exist in the United States, since the data only pertain to those students who actually participate in the AP program by taking an AP exam. We gain a clearer understanding of the characteristics of students who take AP exams when we also take into account the high schools they attend. By linking data on students from the AP file to data on their high schools obtained from the U.S. Department of Education, we are able, for the first time, to answer three essential questions for the 2003-04 school year:

1. What is the availability of the AP program in the nation's public high schools?

Definition: The AP program is considered to be available in a public high school if at least one student in that school took an AP examination.

Typically reported by the College Board is the number or percentage of schools offering an AP exam. Given that universe, this report examines how AP offerings differ among public schools that share important characteristics. This report also examines the intensity[21] of AP offerings in these schools.

2. What proportion of the nation's public high school students participate in the AP program?

Definition: A student is considered to have participated in the AP program if he or she took any one of the 34 AP examinations offered by the College Board in 2003-2004.

Typically reported are overall counts of students disaggregated by subgroups. This report looks at participation patterns in public schools with different socioeconomic, racial/ethnic, and geographic characteristics.

3. What is the level of student performance on AP exams among the nation's public high school students?

Definition: Student performance is defined by AP grades. Students may be eligible for advanced placement or college credit if they earned a grade of 3 or higher on any AP exam (AP exams are graded from a low of 1 to a high of 5).

Typically reported are overall AP grade distributions by subject and student subgroups. This report examines AP performance for public schools with different socioeconomic, racial/ethnic, and geographic characteristics.

Examining data on average rates of participation in and performance on AP exams can mask important differences in the availability of educational opportunity to students attending different types of schools. For all three of these questions, we are interested in what the data reveal for different groups of high schools and for different groups of students within those high schools. Obviously, U.S. public high schools differ on many dimensions, including size, student/teacher ratios, socioeconomic status, and geographic locale. For this report we sought to categorize this large number of schools into smaller, more meaningful groups based on the extent to which particular features were common across the schools. This report uses a clustering methodology, described in the following section, to group the nation's high schools on the basis of important characteristics.

In addition, the analyses disaggregate the data for males and females, for racial/ethnic groups of students, and for students eligible and not eligible for free and reduced-price lunch (a proxy for socioeconomic status or low income). Thus, the data provided in this report allow a richer and more detailed understanding of how different types of public schools and students differ in their access to the AP program.

[21] For the purpose of this report, schools offering at least one AP exam were defined as "Low AP" schools while those offering at least one AP mathematics course, at least one AP science course, and at least one AP English course were defined as "High AP" schools.

Cluster Analysis

To answer the three research questions, we used data from the U.S. Department of Education to classify the nation's schools into a limited but meaningful set of categories, each category sharing important characteristics. We then added data on AP participation and performance for 2004 that was supplied by the College Board. This section provides additional details on the cluster analysis and on the merging of the databases.

For the cluster analysis, we used the U.S. Department of Education's Common Core of Data, 2003-2004 Public Elementary and Secondary School Universe Survey Data (CCD). CCD is a comprehensive, annual, national statistical database of all public elementary and secondary schools and school districts and contains data that are designed to be comparable across all states. The annual survey provides general information about each responding school (name, location, type of school, etc.), information about students (demographic breakdowns, grade levels, etc.), as well as number of teachers per school. This data set yielded 22,037 public high schools located in the 50 states and Washington, D.C. in 2004.

To form the categories, we undertook a cluster analysis, a technique that has been used previously in secondary and higher education research to combine student characteristics, teacher attitudes, and institutional profiles.[22] This technique allows us to view consistent patterns within highly variable and complex data sets. While this technique enhances the meaningfulness of the analysis, it necessarily reduces the information available in forming "like" groups. In our clustering procedures we used five school-level variables to distinguish and form each cluster or group (see Table 2).

Table 2

Variables Used to Create Clusters

Variable	Notes
Number of students in the high school (Size)	School size ranged from 1 student to 5,111 students.
Pupil to teacher ratio (P/T Ratio)	This ratio ranged from .8 students per teacher to over 100 students per teacher.
Percent of students receiving free or reduced priced lunch (%FRPL) (Proxy for percent of students classified as low-income[23])	Some schools reported none of their students received free or reduced priced lunch, while other schools indicated all of their students did.
Percent of under-represented minority students (%Underrep)	This percentage ranged from 0 in some schools to 100 in others.
Locale of the school (Locale)	The plurality of schools (40 percent) in the dataset were classified as rural. Over one-quarter (27 percent) were in suburbs, 22 percent in urban settings, and 11 percent in small or large towns.

[22] Alexander Astin, "An Empirical Typology of College Students," *Journal of College Student Development*, 34, 36-46, 1993; Rhonda Christensen and Gerald A. Knezek, *Constructing the Teachers' Attitudes Toward Computers (TAC) Questionnaire*, paper presented at the Annual Meeting of the Southwest Educational Research Association, New Orleans, Louisiana, 1996; D. Taylor, *A Typology of School Climates Based on Teacher Participation: A Q-Technique Study with School as the Analytic Unit*, paper presented at the Annual Meeting of the American Educational Research Association, San Francisco, California 1992; Marc Pomplun, *Cluster Analysis: A Method to Develop School Level Normative Score Profiles to Support School Improvement*, paper presented at the Annual Meeting of the American Educational Research Association, Seattle, Washington, 2001; Chun-Mei Zhao, Robert M. Gonyea, and George D. Kuh, *The Psychographic Typology: Toward Higher Resolution Research on College Students*, paper presented at 43rd AIR Forum, Tampa, Florida, May 2003.

[23] The "free and reduced-price lunch" is frequently used as a proxy for low-income status. Although an imperfect way of measuring income level, it was the only income indicator available for the current analysis.

The cluster analysis revealed six meaningful clusters. These six clusters accounted for about half of the variation (variance = .54) in the five school-level variables among the 22,037 public schools. (See Appendix A for more information about cluster analysis methodology and resulting statistics.) Four of the six clusters accounted for 98 percent of the high school student population; for clarity, we include only these four clusters throughout the rest of this report.

Cluster Summaries

Table 3 provides descriptive information on all of the variables used in the clustering. In addition, we include median PSAT/NMSQT® scores from the schools in the particular category for which such scores are available.[24] This information is included as a rough proxy for overall school academic achievement level. The number of schools with PSAT/NMSQT scores is noted in the table, indicating that a sizable number of schools in the analysis do not have PSAT/NMSQT scores.[25] The table also indicates the school type, which is broken down into four categories: regular, special education, vocational, and alternative/other (see Table B1 for definitions). Also in Table 3, we report cluster distributions by the College Board geographic regions (see Table 4).

Cluster A: Schools in Cluster A enroll 8 percent of all U.S. public high school students. Typically, the schools are small, with small class sizes, very few underrepresented minority students, while approximately one-third of the students are from low-income backgrounds. Median PSAT/NMSQT scores are moderate. These schools are predominantly rural, with nearly half in the Midwestern United States.

Cluster B: Cluster B enrolls 22 percent of the nation's public high school students. These schools tend to be very large, with large class sizes, many low-income students, and a large underrepresented minority population. Their median PSAT/NMSQT scores are the lowest among the four clusters. Most Cluster B schools are in urban areas throughout the nation. One-fifth of the schools are categorized as "alternative/other."

Cluster C: More than half (53 percent) of U.S. public high school students are enrolled in Cluster C schools. These schools tend to be very large, with relatively low proportions of low-income and underrepresented minority students. Schools in this category tend to have the highest median PSAT/NMSQT scores. About half of the schools are located in suburban areas across the country.

Cluster D: Schools in Cluster D enroll 15 percent of U.S. public high school students. Typically these predominantly rural, medium-sized schools have about one-quarter of their student body comprising underrepresented minority students, almost half of whom are from low-income backgrounds. Their median PSAT/NMSQT scores are moderate. These schools are in areas of the country where large numbers of underrepresented minorities live outside of urban areas.

Merging CCD and AP Data

Since the purpose of this report is to examine AP participation and performance data within the context of important school-level characteristics, we needed to merge the CCD data with AP data. To provide the AP data, we used the College Board's 2004 AP administration file that includes *all* examinees in grades nine to 12. This file also lists individual student performance by exam, student characteristics (race, sex, exam-fee reduction, etc.) as well as the school the student attended. In 2004, 11,130 U.S. public high schools were identified as administering AP exams to 877,848 students.

Because the 2004 AP administration file identifies the high school that each AP student attended, we matched that file with the 2004 CCD file, creating a new data base containing, for each school, both AP data and data on school characteristics.

While this merged database allows us to examine AP participation within the context of school characteristics, it underestimates AP participation to the extent that some students who are not identified as AP participants in their high schools may ultimately participate in the program — for example, a ninth-grader in 2004 who participates as a 12th-grader in 2007. One alternative would be to include data only for 12th-graders in 2004. But because we know that fewer than half of all AP examinees in 2004 were 12th-graders, this also would result in an underestimate. In addition, the College Board, in

[24] The PSAT/NMSQT exam, owned by the College Board and the National Merit Scholarship Corporation, is designed to measure students' critical reading and math problem-solving skills. Each of the sections range in score from 20 to 80 points. It is reported that the average score for juniors is around 49 on each section (http://www.collegeboard.com/student/testing/psat/scores.html).
[25] PSAT/NMSQT scores were not one of the variables used in creating the clusters. We included the information only to provide a more detailed picture of the clusters.

Table 3

Cluster Summary

	Cluster			
	A	**B**	**C**	**D**
Number of schools	4,849	2,709	6,588	3,637
Median Number of Students	144	974	1,007	453
Median Percentage of FRPL	29	55	13	44
Median Percentage of Under-represented Minority Students	2	77	10	26
Median Pupil/Teacher Ratio	12	19	18	16
Median PSAT/NMSQT® Score (n)	93 (3,440)	80 (1,790)	96 (5,517)	90 (2,863)
Locale (%)				
Rural	83	0	19	58
Town	11	0	9	26
Suburb	5	27	51	15
Urban	1	73	22	0
Type of School (%)				
Regular	87	76	89	92
Special Education	3	1	1	0
Vocational	1	2	1	0
Alternative/Other	9	21	9	7
Region (%)				
Middle States	10	15	17	4
Midwest	49	17	32	19
Northeast	6	3	6	1
South	9	18	14	39
Southwest	12	15	6	18
West	14	33	24	19

Sources: College Board 2004 AP Administration File and U.S. Department of Education Common Core of Data, 2003-2004 Public Elementary and Secondary School Universe Survey Data analyzed by Educational Testing Service.

Table 4

States by College Board Region

College Board Region	States
Middle States (MS)	DC, DE, MD, NJ, NY, PA
Midwest (MW)	IA, IL, IN, KS, MI, MN, MO, ND, NE, OH, SD, WI, WV
New England (NE)	CT, MA, ME, NH, RI, VT
South (S)	AL, FL, GA, KY, LA, MS, NC, SC, TN, VA
Southwest (SW)	AR, NM, OK, TX
West (W)	AK, AZ, CA, CO, HI, ID, MT, NV, OR, UT, WA, WY

Source: The College Board.

its annual *Advanced Placement Report to the Nation,* reports on the accumulated AP experiences of graduating high school seniors over their academic careers. These data provide an important summary of AP participation at the national and state levels. However, since the focus of this study is relative AP participation within the context of important school characteristics, we chose the AP 2004 Administration File as the best match for the CCD file because both files provide a snapshot of public high school students in the same year.

After we merged the databases, we conducted a series of descriptive analyses that first related school clusters to the outcome measures of AP availability, participation, and performance. We also analyzed participation and performance of students with different characteristics within and across school clusters.

The first question we address is the availability of the AP program at the school level. We identify a high school as "offering" the AP program if at least one student in the school took an AP examination, regardless of the subject. However, schools can differ in their intensity of AP course offerings — from one or two AP exams in one discipline area, to offerings that include a significant portion of courses from each disciplinary area. Several reports have discussed the importance of offering a portfolio of courses. It is often recommended that courses be available in English-language arts, mathematics, and science/computer science.[26] Therefore, our analyses separated public schools that offer AP courses into "High AP" and "Low AP" schools. We identified a "High AP" school as one administering at least one AP English exam, at least one AP math exam, *and* one of the AP Sciences/Computer Sciences exams. Those that failed to meet the preceding criteria but that administered at least one AP exam in 2004 were classified as "Low AP."[27] It is important to understand that our definition of AP availability refers only to the presence of AP in the school, as evidenced by at least one AP exam. This does not imply, however, that the courses are, in practice, available to all students.

Within clusters, the main difference between "High AP" and "Low AP" schools is the size of the student population; the former are typically 1.6 to 2.0 times larger than the latter. The other characteristics upon which the clusters were built (percent of low-income students, percent of underrepresented minority students, etc.) do not tend to vary within cluster to a significant degree across AP intensity.

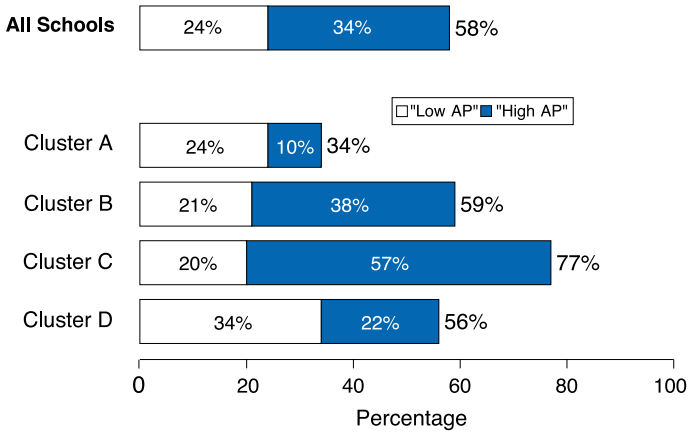
The data show that, overall, more than half of the nation's public high schools (58 percent) offer some type of AP program (n=10,399). These high schools enroll 85 percent of the nation's students. Sixty-four percent of students are in "High AP" schools.

There are differences in availability of AP to students of varying backgrounds. Table 5 shows that African American students are the most likely to attend schools that do not offer any AP program. Nineteen percent of African American students attend such schools, compared with only 6 percent of Asian American students, 12 percent of Hispanic students, and 14 percent of White students. Similarly, low-income students are much more likely to attend a school that does not offer AP programs than other students (19 percent vs.12 percent).

Figure 3 shows the percentage of high schools that offer AP programs, overall and by cluster. Of the 58 percent of public high schools offer AP, 34 percent are classified as "High AP" while 24 percent are classified as "Low AP." Across the school clusters, there are some substantial differences. Schools in Cluster C have the highest rate of AP offerings, both in terms of offering any AP program and of offering high-intensity programs. Seventy-seven percent of the schools in Cluster C offer AP and more than half are classified as "High AP." Cluster C schools constitute the largest proportion of more economically secure suburban schools. Cluster A, composed of relatively small schools, has the lowest proportion of schools offering AP at any level (34 percent). While Clusters B (largely urban) and D (medium-size, rural schools) have similar levels of overall offerings, the Cluster B schools are more likely to have more intense AP programs.

Figure 3

Percentage of U.S. High Schools Offering the AP Program by Intensity of the AP Program



Sources: College Board 2004 AP Administration File and U.S. Department of Education Common Core of Data, 2003-2004 Public Elementary and Secondary School Universe Survey Data analyzed by Educational Testing Service.

[26] Adelman, 2006; National Academy of Sciences, 2007.
[27] Often, the "Low AP" schools administered exams in more than one AP course. The median number of courses offered across the clusters for "Low AP" schools ranged from two to three courses, while the "High AP" schools' median number of courses ranged from five to 12, depending on the cluster.

Table 5

Proportion of High School Students in Schools With Varying Levels of AP Program Participation by School Cluster, Race/Ethnicity, and Socioeconomic Status

	Cluster				
	A	**B**	**C**	**D**	**Total**
Number of Students (000)	1,042	3,100	7,242	2,140	13,524
Percent of Students Attending Schools:					
Not Offering AP	40	15	8	24	14
Offering AP	60	85	92	76	85
"Low AP"	34	21	15	35	21
"High AP"	26	64	77	41	64
	Race/Ethnicity				
	African American	*Hispanic*	*White*	*Asian*	
Number of Students (000)	2,092	2,112	8,258	633	
Percent of Students Attending Schools:					
Not Offering AP	19	12	14	6	
Offering AP	81	88	86	94	
"Low AP"	25	17	22	12	
"High AP"	56	72	64	83	
	Socioeconomic Status				
	Low-Income	*Non-Low-Income*			
Number of Students (000)	3,978	9,465			
Percent of Students Attending Schools:					
Not Offering AP	19	12			
Offering AP	81	88			
"Low AP"	26	19			
"High AP"	56	68			

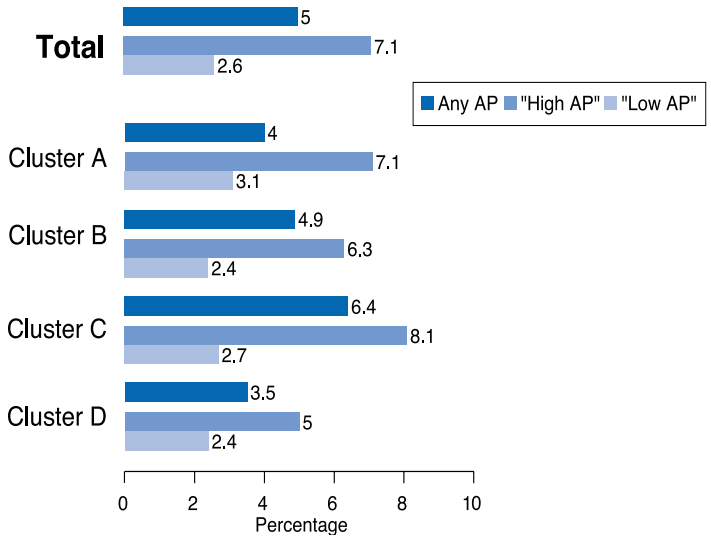
Sources: College Board 2004 AP Administration File and U.S. Department of Education Common Core of Data, 2003-2004 Public Elementary and Secondary School Universe Survey Data analyzed by Educational Testing Service.

We previously described the availability of the AP program across public high schools. The fact that students attend schools that offer the AP program does not, however, mean that students in these schools participate equally in these courses. This section of the report examines participation of students within schools. For the purpose of the study, a student is considered to have participated in the AP program if they took any AP exam, regardless of the grade earned on the AP exam taken.

Figure 4 shows the median percentage of students who participate in the AP program by taking an exam, by school category or cluster, in all high schools offering any AP. We then examine "Low AP" and "High AP" schools separately. Overall, 5 percent of all high school students who attended schools that offered AP actually took an AP examination.[28] The participation rates among clusters vary somewhat — from about 4 percent in clusters A and D (smaller schools) to 6.4 percent in cluster C (larger schools). Thus, while more than half of all public high schools offer the AP program, a much smaller proportion of students actually participate, as defined by their taking an AP examination.

Figure 4

Median Percentage of Students Participating in the AP Program by Cluster



Sources: College Board 2004 AP Administration File and U.S. Department of Education Common Core of Data, 2003-2004 Public Elementary and Secondary School Universe Survey Data analyzed by Educational Testing Service.

The key point illustrated by Figure 4 is that the overall number of students taking at least one AP exam in 2004 was a small fraction of the entire student population. In "Low AP" schools, participation is 3 percent or less of the student body. Even in "High AP" schools, only 5 percent to 8 percent of students take an exam.

Not surprisingly, students in "High AP" schools are more likely to participate in AP by taking an exam than students attending schools classified as "Low AP." For all high schools, 7.1 percent of students attending "High AP" schools participate in AP by taking an exam, compared with only 2.6 percent of students in "Low AP" schools.

The data also suggest that there are some differences across the "High AP" clusters. For example, students in "High AP" schools in clusters C and A (few underrepresented minority and low-income students), were somewhat more likely to participate in AP by taking an exam. "Low AP" schools tended to have relatively similar levels of participation, regardless of cluster. What then are the characteristics of the students who participate in AP by taking an exam?

Figure 5 shows the proportion of females and males in each school cluster and intensity level who participate in the AP program. Overall, 6.1 percent of female high school students take an exam, compared with 4.3 percent of males. At all levels of intensity and across all clusters, females are consistently more likely to take at least one AP exam.

There are also substantial differences in overall median exam participation rates among racial/ethnic groups:

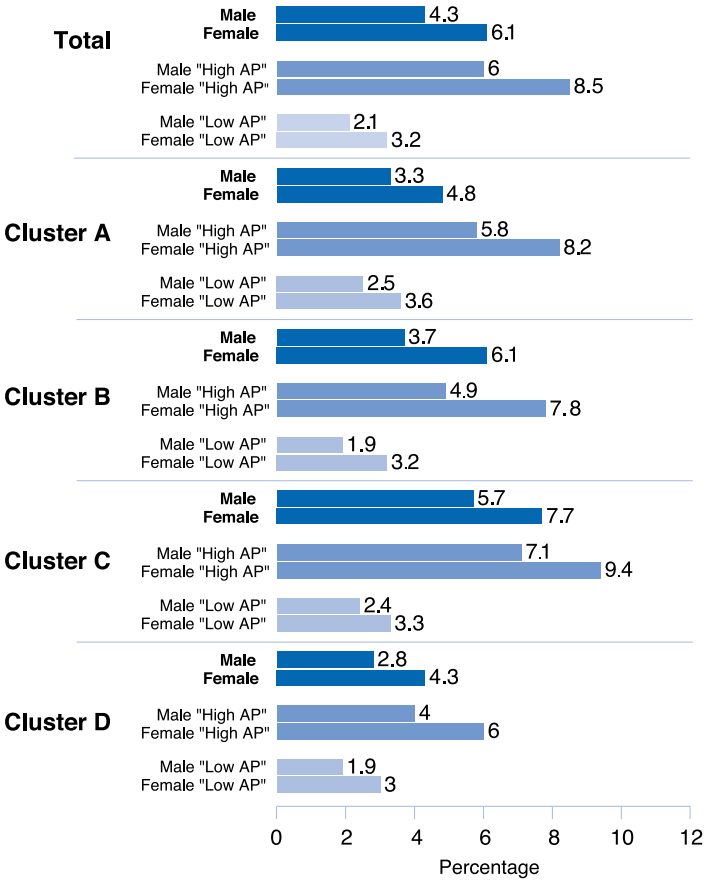
- Asian American 10.3 percent
- White 5.3 percent
- Hispanic 2.4 percent
- African American .5 percent

Figure 6 shows the proportion of different racial/ethnic groups who participate in the AP program by taking an exam in "Low AP" schools and in "High AP" schools. Among "Low AP" schools in Clusters A, C, and D, the median participation (in percentage points) is above zero for White students only. This is particularly

[28] In measuring student participation in AP, median percentages are reported. The median is a measure of central tendency defined as the value in a distribution that occupies the middle position in a rank order of values, separating the top half and the bottom half of the distribution. The median was chosen because the distributions of AP participation were skewed. The 5 percent statistic reported here means that half of public high schools offering AP have 5 percent or fewer of the students taking an AP exam, while the other half of public high schools offering AP have 5 percent of more of the students taking an AP exam.

Figure 5

Median Percentage of Students Participating in the AP Program by Gender and Intensity of the AP Program



Sources: College Board 2004 AP Administration File and U.S. Department of Education Common Core of Data, 2003-2004 Public Elementary and Secondary School Universe Survey Data analyzed by Educational Testing Service.

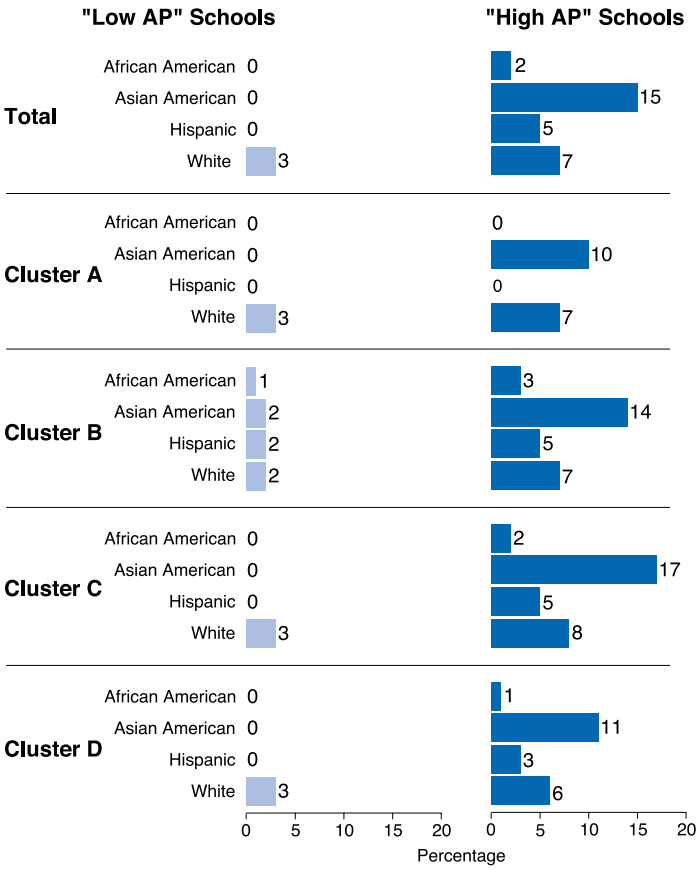
troubling in Cluster D, in which about one-quarter of the students are from underrepresented minority groups. Only in Cluster B, which has the highest population of minority students, is there participation by all four racial/ethnic groups. But, even in Cluster B the exam participation for all racial/ethnic groups is less than 3 percent.

Figure 6 also presents racial/ethnic breakdowns for "High AP" schools. Overall, in these schools 15 percent of Asian American students participate in AP by taking an exam, compared with 7 percent of White students, 5 percent of Hispanic students, and 2 percent of African American students. Across clusters, we see very clearly that underrepresented minorities, particularly African American students, are much less likely to take an AP exam than White and Asian American students. Among Hispanic students, those in Clusters B and C (large, urban/suburban schools) are more likely to participate in AP. The participation in "High AP" schools of White students is fairly consistent across all clusters, hovering between 6 percent and 8 percent. Asian American students have the highest level of exam participation across all clusters and are twice as likely as White students in Clusters B and C to participate by taking an exam.

Finally, differences in AP exam participation rates were examined for high- and low-income students. Figure 7 shows that low-income students are much less likely to participate in the AP program (0.4 percent compared with 6.2 percent). Low-income students in Cluster B (large, low-income schools) are the most likely to participate in AP. In fact, looking at the exam participation rates of low-income students across all four clusters of schools, only in Cluster B "High AP" schools does the participation of low-income students rise above 1.3 percent.

Figure 6

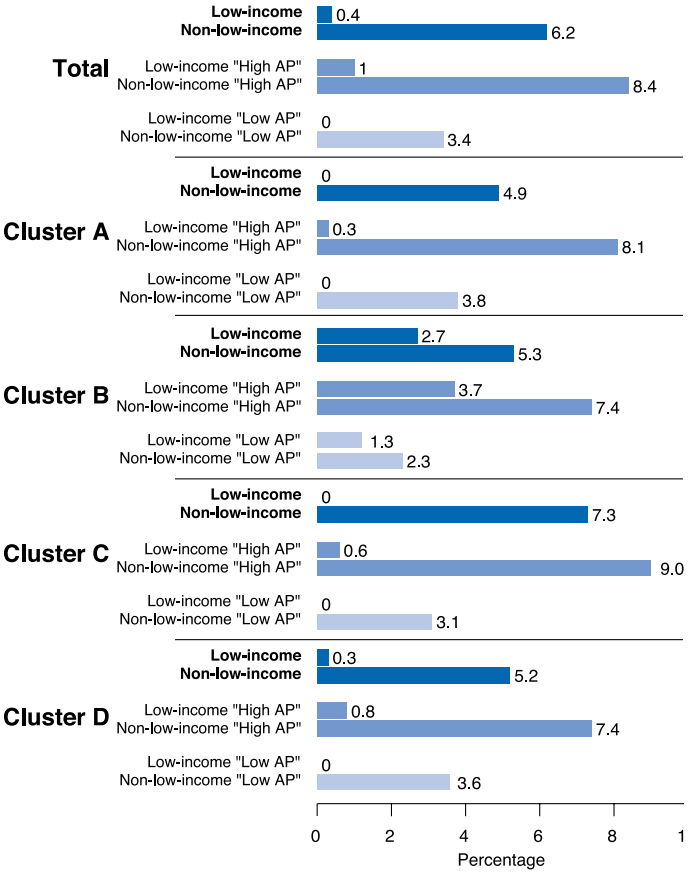
Median Percentage of Students Participating in the AP Program by Race/Ethnicity and Intensity of the AP Program



Sources: College Board 2004 AP Administration File and U.S. Department of Education Common Core of Data, 2003-2004 Public Elementary and Secondary School Universe Survey Data analyzed by Educational Testing Service.

Figure 7

Median Percentage of Students Participating in the AP Program by Low-Income Status and Intensity of the AP Program



Sources: College Board 2004 AP Administration File and U.S. Department of Education Common Core of Data, 2003-2004 Public Elementary and Secondary School Universe Survey Data analyzed by Educational Testing Service.

Though the AP program has expanded to the point that 85 percent of students attend schools that offer AP, when we look inside those schools, it becomes clear that there remains a tremendous gap in who participates by taking an AP exam. African American, Hispanic, and low-income students are less likely to participate, even when they come from schools in which they are in the majority. Indeed, these patterns of unequal access are consistent across all categories of schools.

Previous research has found the most predictive indicator of college readiness is the actual grade obtained on the AP examination, not simply taking the examination.[29] There are several ways to measure a school's AP performance, though each has its shortcomings. We have chosen to emulate the College Board and simply identify the percentage of students who received a grade of 3 or higher on at least one examination. As this metric is similar to that used by the College Board to measure AP access and performance, it is already familiar to educators and parallels official AP reporting. The shortcoming of this approach is that it has an upward bias in estimating student performance. For example, a student who received one grade of 3 and two grades less than 3 would be counted equally with a student who took three exams and earned a 3 on each.

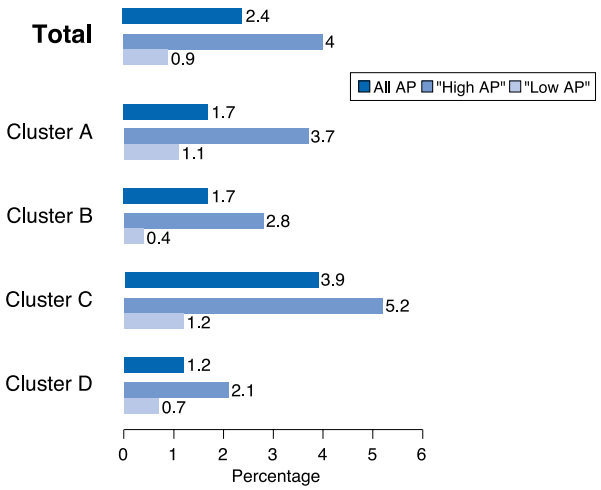
Using this definition of AP performance, our analysis revealed that just 2.4 percent of the nation's public high school students participated in AP by taking an exam and received a grade of 3 or higher. In "High AP" schools the median percentage increases to 4, and in "Low AP" schools the median percentage drops to slightly less than 1 (see Figure 8). As we found when looking at student participation, there are similar proportions of students earning at least one AP grade of 3 across categories within schools of similar AP intensity. "High AP" schools, regardless of cluster, have a greater proportion of students participating and earning a grade of 3 or higher in AP than do "Low AP" schools.

In fact, the differences in performance between "High AP" schools and "Low AP" schools are not completely explained by the different levels of participation. As seen in the data shown in Figure 4, students in "High AP" schools are almost three times more likely to participate in AP by taking an exam than are students in "Low AP" schools. However, as shown in Figure 8, students in "High AP" schools are almost four times more likely to receive a grade of 3 or higher on an AP exam than are students in "Low AP" schools. This pattern is relatively consistent across the clusters. This finding indicates that differences in the percentage of students receiving a grade of 3 or higher by AP intensity level cannot be fully explained by AP participation rates. Students who participate in AP by taking an exam in "High AP" schools are more likely to receive a grade of 3 or higher than those who participate in AP in "Low AP" schools.

The other critical point in Figure 8 is that if obtaining a grade of 3 or higher is an indication of a student's qualification to receive college credit and/or advanced placement, a low percentage of public high school students are eligible for that benefit. Even among

Figure 8

Median Percentage of Students Scoring a "3" or Higher on at Least One AP Exam by Cluster and Intensity of the AP Program



Sources: College Board 2004 AP Administration File and U.S. Department of Education Common Core of Data, 2003-2004 Public Elementary and Secondary School Universe Survey Data analyzed by Educational Testing Service.

"High AP" schools only 2.1 percent to 5.2 percent of the students in any of the clusters are succeeding in the AP program. The proportion of students eligible for college credit in "Low AP" schools ranges from only 0.4 percent to 1.2 percent.

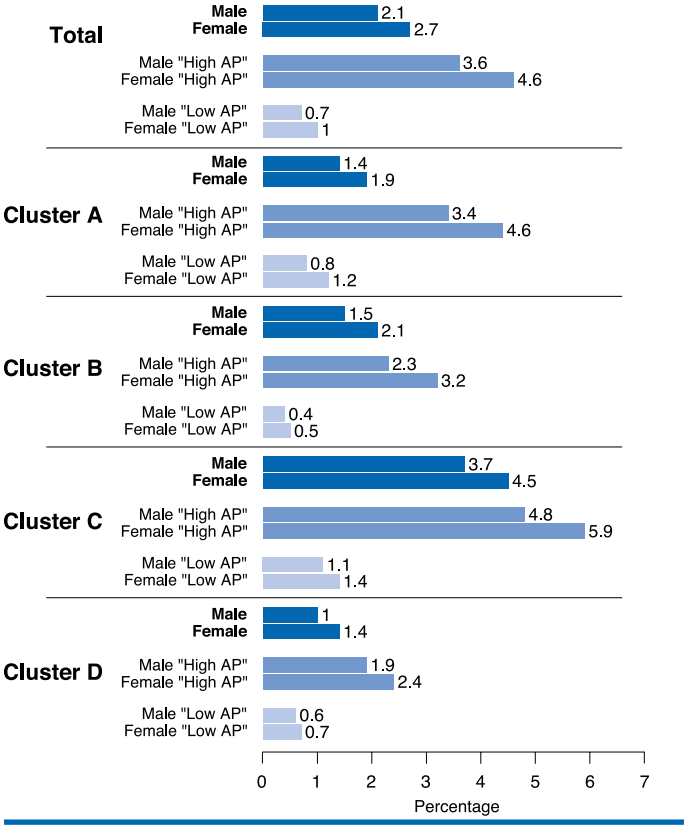
Figure 9 shows the percentage of female and male students taking an AP exam and receiving grades of 3 or higher. Across all U.S. public high schools, females (2.7 percent) were more likely to earn grades of 3 or higher than males (2.1 percent). Across all high school clusters and nearly all levels of AP intensity, females are more likely to participate and earn a grade of 3 or higher on an AP exam. However, males who participate in AP are slightly more likely to receive a grade of 3 or higher than are females (about 49 percent of males compared with 44 of females). The differences in the percentage of students who receive a grade of 3 or higher that are shown in Figure 9 are due to the fact that more females participate in AP by taking an examination.

Across all public high schools, the median percentage of students who earn a grade of 3 or higher on an AP exam ranges from a high of 4 percent of Asian American students, to 2.8 percent of White students, to 0.6 percent of Hispanic students, to a median of 0 percent for African American students. The median percentage of African American students who participate and succeed in AP is nearly 0 in every cluster, regardless of AP intensity

[29] Dodd et al., 2002.

Figure 9

Median Percentage of Students Scoring a "3" or Higher on at Least One AP Exam by Cluster and Intensity of the AP Program

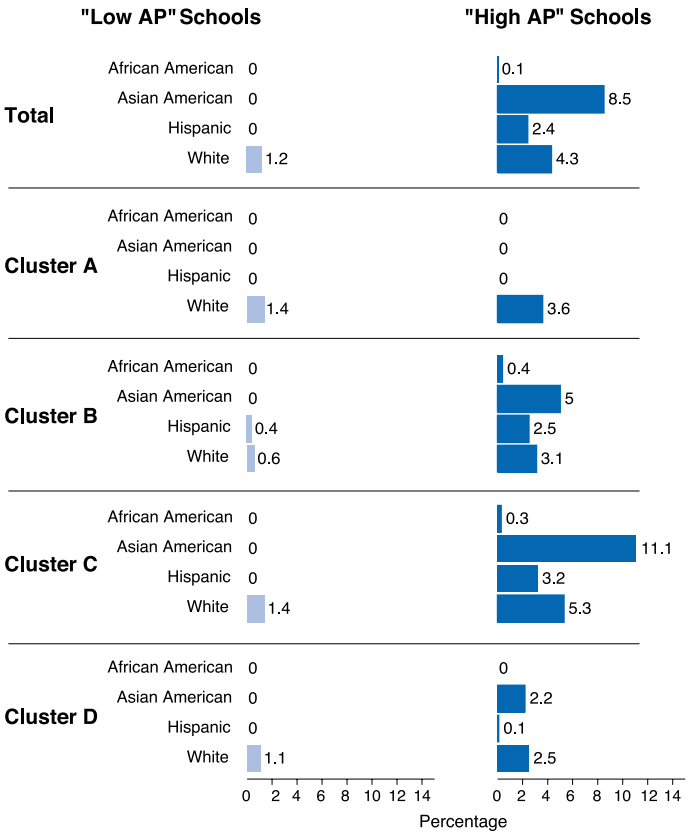


Sources: College Board 2004 AP Administration File and U.S. Department of Education Common Core of Data, 2003-2004 Public Elementary and Secondary School Universe Survey Data analyzed by Educational Testing Service.

(see Figure 10). Generally, the percentage of Hispanic students earning a grade of 3 or better is similar to that of African American students with the exception of "High AP" schools in Clusters B and C, where their percentages are similar to those of White students. In most of the "Low AP" schools, it is only White students who are succeeding — yet, even then only about 1 percent or fewer can be said to succeed. Few Asian students are earning AP grades of 3 or higher outside of the "High AP" schools in Clusters B and C.

Figure 10

Median Percentage of Students Scoring a "3" or Higher on at Least One AP Exam by Cluster, Race/Ethnicity, and Intensity of the AP Program

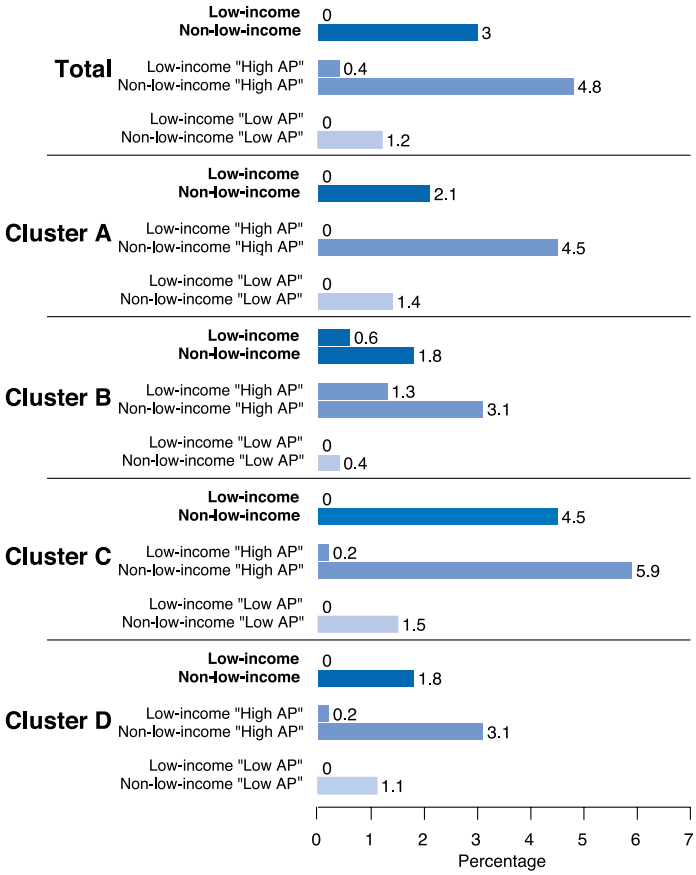


Sources: College Board 2004 AP Administration File and U.S. Department of Education Common Core of Data, 2003-2004 Public Elementary and Secondary School Universe Survey Data analyzed by Educational Testing Service.

Overall, 3 percent of non-low-income students earn a grade of 3 or higher, compared with a median of 0 percent of low-income students. Regardless of cluster or AP program intensity, very few low-income students are earning college credit or advanced placement. Figure 11 shows the highest percentage of low-income students who earned at least a 3 on one or more AP exams comes from Cluster B, where only 1.3 percent of the low-income students participated and earned a grade of 3 or higher on their exams.

Figure 11

Median Percentage of Students Scoring a "3" or Higher on at Least One AP Exam by Cluster, Low-Income Status, and Intensity of the AP Program



Sources: College Board 2004 AP Administration File and U.S. Department of Education Common Core of Data, 2003-2004 Public Elementary and Secondary School Universe Survey Data analyzed by Educational Testing Service.

Previous studies have found that high school students who take and succeed in rigorous academic coursework are more likely to enjoy later academic and professional success. For the nation to prosper in a global economy, we need to focus on making sure that *all* groups of students achieve academic success — not just some groups. With that goal in mind, this study has examined one of the largest providers of rigorous high school curriculum, one that is also research supported — the College Board's AP Program.

Combining data from two national datasets and clustering more than 22,000 U.S. public high schools into four categories based on school characteristics has allowed for a unique, national analysis at the school level of AP program availability, participation, and performance. Our analysis found several gaps between schools and students with regard to these outcomes.

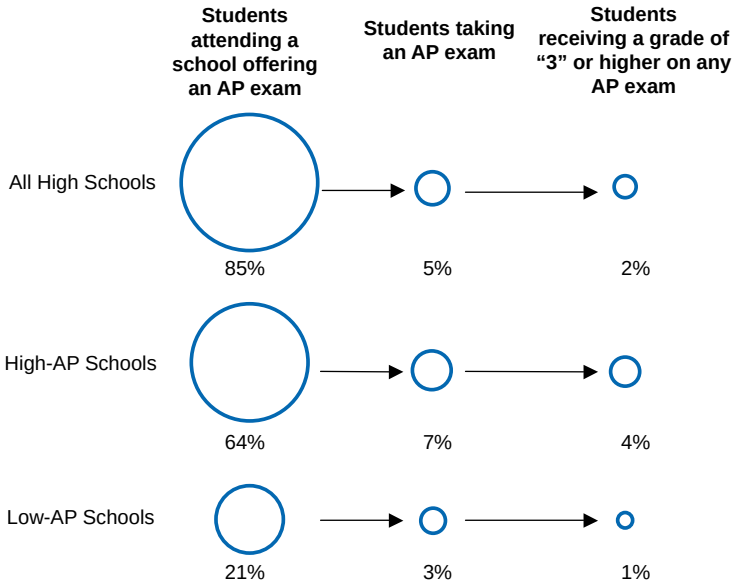
School types vary in the degree to which they offer AP. Clusters made up of the larger schools in more densely populated areas were more likely to offer an AP program than smaller, more rural school clusters. The large, low-poverty, low-underrepresented minority schools in Cluster C were the clear leaders, with more than three-quarters of their schools offering some AP programs, most offering programs at a high intensity. The next highest cluster with regard to offering AP was the large, much more racially and financially diverse Cluster B, in which about half of the schools offer AP.

Once differences among schools in AP program intensity are taken into account, public high schools are similar with regard to AP exam participation and student performance. Despite differences in school clusters, the results show similarly low proportions of students both taking at least one AP exam and earning at least one AP grade of 3 or better. The "High AP" schools were similar across clusters, as were the "Low AP" schools. The greatest differences were among the "High AP" and "Low AP" schools within the clusters.

Few students are participating in AP programs and scoring well enough on AP exams to potentially earn college credit and/or placement. At the typical U.S. public high school that offers the AP program, just 5 percent of the students participate in the program as evidenced by taking at least one AP exam. Figure 12 depicts the alarming gap between the 85 percent of students who attend schools that offer AP courses and the 2 percent who actually take an AP exam and earn a score of 3 or higher. Theproportion of students participating is greatest in "High AP" schools (5 percent to 8 percent). In terms of performance in AP, only 2 percent to 5 percent of students in "High AP" schools participate and earn a grade of 3 or greater. Participation and performance outcomes are smaller still in "Low AP" schools.

Figure 12

Overall Summary of Public High School Students' Exposure to the AP Program



Sources: College Board 2004 AP Administration File and U.S. Department of Education Common Core of Data, 2003-2004 Public Elementary and Secondary School Universe Survey Data analyzed by Educational Testing Service.

Low-income students are consistently lagging behind their more-advantaged peers. Regardless of the type of school they attend — large or small, urban or rural — very few low-income students are taking AP exams. The picture is even bleaker with regard to their exam performance. Across most levels of AP program intensity, regardless of cluster, the median proportion of low-income students participating in the AP program and earning a grade that will gain them college credit and/or placement is 0 percent.

Although there has been some success in introducing the AP program into diverse schools, there continues to be a lack of underrepresented minorities among AP examinees. Even within highly diverse schools, such as those in Clusters B and D, underrepresented minority students are less likely to have taken an exam than their White and Asian American classmates. Perhaps most troubling is that the median percentage of African American students who participate and succeed in AP programs is nearly 0 in every cluster, regardless of AP program intensity.

Finally, gender differences are evident for each of the measures used in this study. Girls are more likely than boys to participate in AP and earn a grade of 3 or higher.

The data assembled in this report indicate that the AP program is available in most public high schools. Yet the results also show that very few students take AP exams and score 3 or higher. Further, AP program participation remains relatively rare among low-income and minority students. Thus, there are significant challenges to ensuring that rigorous academic offerings are available to all students.

The percentage of students taking at least one AP exam is minimal, and at or close to zero for African American and low-income students. The AP program is a means of introducing students to academic rigor, which in turn is believed to be an important determinant of future academic success. But our data reveal that a very small percentage of high school students, mostly consisting of majority group and Asian American students, participate in the program.

For more students to reap the benefits of AP program participation, public schools need to make greater efforts at broadening their programs and creating a culture of academic rigor within their schools — a culture that paves the way for successful AP program participation for large numbers of students. Students in general and students in underrepresented subgroups in particular are more likely to participate in AP programs in schools that offer more high-intensity programs.

Some segments of the public high school population may especially benefit from efforts to expand the level of advanced academic coursework. For example, small, rural, low-income schools are less likely than other types of high schools to participate in the AP program. In addition, underrepresented minority and low-income students are particularly underserved by the program.

The availability of an AP program in a school is, of course, necessary for student participation. But it is insufficient on its own; even in many schools classified as "High AP," few students take at least one AP exam.

Recommendations for Future Research

To understand the factors that limit participation, research should focus on:

- Identifying and providing the educational experiences that students need in order to be prepared for advanced coursework.
- Policies for student placement into academic tracks or programs.
- Ways to encourage students to prepare for and participate in advanced academic programs. Both underrepresented minority students and males tend to take fewer AP courses, even when an AP program is available in their schools. There are programs designed to encourage underrepresented minority students to consider AP and advanced coursework early in their school careers. But more knowledge is needed about which of these programs are having an impact and, more importantly, why they are succeeding, if in fact they are.
- Identifying the issues keeping low-income students from AP participation even when opportunities and fee-reduction opportunities are present. The number of fee-reduced exams increased from nearly 83,000 in 1999 to more than 190,000 in 2004, a growth of 129 percent. This growth far outpaced the growth (60 percent) in non-fee-reduced exams during the same period. Though there is no doubt that these popular test-fee-reduction programs have had a positive impact on student participation among low-income students, the 2004 data suggest that reducing AP exam fees may not be enough.
- Providing the resources necessary to ensure that AP courses are available for all students who wish to take them.
- Identifying teacher quality issues and staff development needs to ensure that students have access to appropriate instruction.

Unless the opportunity for advanced coursework is made available to growing segments of our underserved student populations, many students will be unable to avail themselves of opportunities for higher education and for successful participation in the workforce.

The grouping, or clustering, of these schools was conducted via agglomorative cluster analysis using minimum variance linkage. The clustering program started with 22,037 clusters, each consisting of only one school. Next, it combined schools that were most similar, followed by another pass through these latest clusters to see if other like schools or clusters could be added to the previously existing clusters. This process repeats until there is just one cluster encompassing all schools. Schools and clusters are combined to minimize the variance or differences of the schools within the cluster, while trying to maximize the differences between the remaining clusters.

It is recommended that all variables used in a cluster analysis should be in the same metric.[30] Therefore, prior to entering the variables into the clustering program, each was transformed onto a common scale, that being percentile rank. For example, each school was sorted by number of students in the high school (HS_03), then given a percentile rank along that distribution (HS_03_PCTL). To further ensure reliability of the clusters, the data were randomly split in half.[31] Each half was run separately through the clustering solution, where it was determined that similar clusters were formed.

In some cases in which schools were missing some of these data elements, the missing information was filled in with data from previous years' CCD surveys. For the few schools for which data were still missing after reviewing the 2002-03 and 2001-02 CCD surveys, multiple imputation was used to estimate the missing values for the percent of students receiving free or reduced lunch, the percent of underrepresented minority students, and the student-to-teacher ratio.

The determination of how many clusters to keep for an analysis is a complex one with no real right or wrong answer. In 1956, George Miller proposed the Magic 7±2 Doctrine that stated individuals can best understand and put to practical use seven clusters, plus or minus two.[32] Review of the eigenvalues calculated in SAS via PROC CLUSTER indicated that there were five attributes in the solution, each one making a noteworthy contribution (proportion > .02). (See Table A1.) Next, we looked at the plot of error, or within variance (1-RSQ) by number of clusters. The most conservative solution is the point at which the error variance begins to level out, indicating a decrease in the heterogeneousness within clusters. As shown in Figure A1 (see p. 26), that point was at the six-cluster mark. With six being within the Magic 7±2 Doctrine, the evaluation of this solution continued. We then checked to be sure that the separation among all clusters at the six-cluster mark (indicated by the Pseudo-*F* or PSF) is greater than the separation among the last two clusters joined (indicated by the Pseudo-t^2 or PST2) going from seven clusters to six. (See Table A2).

Another issue to be considered in cluster analysis concerns the individual cluster sizes. Having clusters so small as to be practically meaningless or too large to have minimal commonality among its members is an issue. We made the decision to only keep a solution if no one cluster is less than 10 percent the size of the largest cluster.[33] Examination of the six-cluster solution indicated that the smallest cluster size (Cluster 2) was 20 percent of the largest cluster (Cluster 5), thereby satisfying the Luan's cluster equity rule. (See Table A3).

Table A1

Eigenvalues of the Covariance Matrix

Attribute	Eigenvalue	Difference	Proportion	Cumulative
1	1433.4894	243.5432	0.3647	0.3647
2	1189.9463	538.6467	0.3027	0.6675
3	651.2996	278.3503	0.1657	0.8332
4	372.94929	90.10914	0.0949	0.928
5	282.84015		0.072	

[30] David B. Jones and James W. Pinkney, "The Use of Cluster Analysis in Programming: Strategic Grouping of Students," *Journal of College Student Development*, 32, 292-296, 1991; David J. Ketchen, Jr. and Christopher L. Snook, "The Application of Cluster Analysis in Strategic Management Research: An Analysis and Critique," *Strategic Management Journal*, 17, 441-458, 1996.
[31] James H. Myers, Segmentation and Positioning for Strategic Marketing Decisions, Chicago: American Marketing Association, 1996; Girish Punji and David W. Stewart, "Cluster Analysis in Marketing Research: Review and Suggestions for Application," *Journal of Marketing*, 20, 134-149, 1983.
[32] George A. Miller, "The Magical Number Seven, Plus or Minus Two: Some Limits on Our Capacity for Processing Information," *The Psychological Review*, 63, 81-97, 1956.

Figure A1

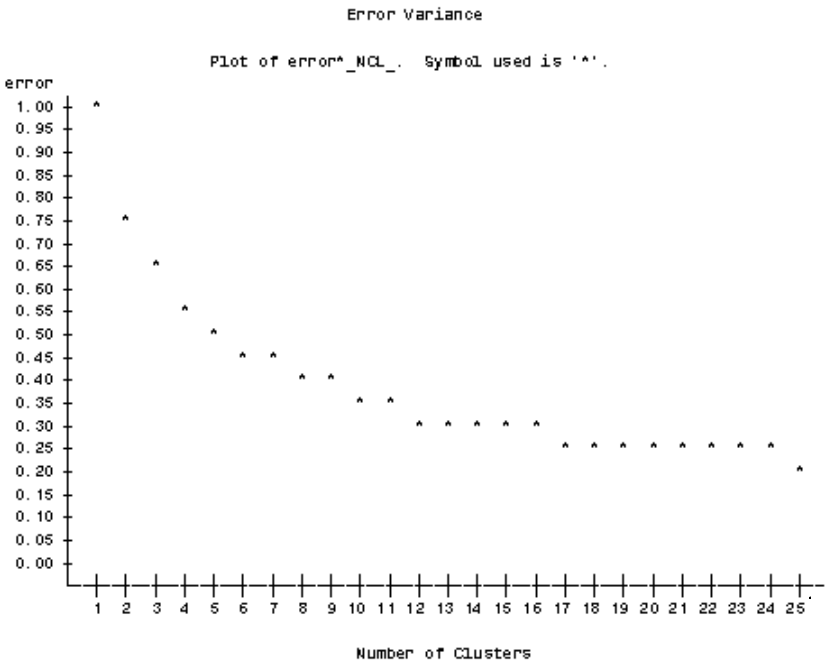


Table A2

Cluster Summary Statistics for 10 to 1 Clusters

Number of Clusters	RMS STD	RSQ	Error (1-RSQ)	PSF	PST2
10	19.46	0.64	0.36	4,369	1,067
9	17.46	0.62	0.38	4,460	1,754
8	19.53	0.60	0.41	4,627	1,627
7	18.27	0.57	0.43	4,872	1,677
6	20.23	0.54	0.46	5,234	1,404
5	23.33	0.50	0.50	5,420	2,301
4	23.06	0.43	0.57	5,556	3,202
3	24.58	0.33	0.67	5,480	4,092
2	24.63	0.23	0.77	6,570	3,785
1	28.04	-	1.00	.	6,570

Table A3

Clusters and Membership

Cluster	Number of Schools per Cluster	Small vs. Large Ratio (reference: Cluster 5)
1	4,849	74%
2	1,313	20%
3	2,941	45%
4	2,709	41%
5	6,588	Reference
6	3,637	55%

Table B1

School Type Codes and Definitions

School Type	Definition
Regular	A public elementary/secondary school that does not focus primarily on vocational, special, or alternative education.
Special Education	A public elementary/secondary school that focuses primarily on special education, including instruction for any of the following: autism, deaf-blindness, developmental delay, hearing impairment, mental retardation, multiple disabilities, orthopedic impairment, serious emotional disturbance, specific learning disability, speech or language impairment, traumatic brain injury, visual impairment, and other health impairments; and that adapts curriculum, materials, or instruction for students served.
Vocational Education	A public elementary/secondary school that focuses primarily on providing formal preparation for semiskilled, skilled, technical, or professional occupations for high school-aged students who have opted to develop or expand their employment opportunities, often in lieu of preparing for college entry.
Alternative/Other	A public elementary/secondary school that addresses needs of students that typically cannot be met in a regular school; provides nontraditional education; serves as an adjunct to a regular school; and falls outside of the categories of regular, special education, or vocational education.

Source: Documentation to the NCES Common Core of Data Public Elementary/Secondary School Universe Survey: School Year 2003-04. Retrieved from: http://nces.ed.gov/ccd/pdf/psu031agen.pdf.

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