
College STEM Outcomes After Four Years of Test-Optional Admissions Policies

**STEM Performance, Persistence, and On-Time Degree
Completion for the Fall 2021 Entering Cohort**

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Executive Summary

The Admissions Research Consortium (ARC) is a collaborative research initiative that aims to help participating institutions gain insight into their own and their peers' admissions processes and outcomes, as well as changes in student behavior influenced by the Covid-19 pandemic. Guided by a Core Advisory Committee and a Research Advisory Committee, evidence and insights from ARC inform future practice and policy in the years following the pandemic. Previously published consortium [research](#) examined changes in post-pandemic applications, admissions, enrollment, and first-year academic performance at ARC institutions.

Math readiness is central to the STEM pipeline. However, colleges have less visibility into students' math readiness than they did before the pandemic. Roughly half of applications to selective colleges now arrive without an SAT score, and students with lower scores are the most likely to withhold them. This brief examines how SAT Math scores and AP STEM participation predict first-year grades and persistence among STEM majors, and on-time degree completion among all enrollees in the fall 2021 entering cohort, the first cohort admitted under widespread test-optional policies. Four key themes emerged from our research.

Theme 1: SAT Math scores predict college STEM majoring and success.

Students with higher SAT Math scores are more likely to be STEM majors in Year 4, have higher first-year GPAs (FYGPAs) as Year-1 STEM majors, have higher rates of persistence in STEM majors, and are more likely to complete their bachelor's degrees in STEM fields within four years.

Theme 2: The relationship between math readiness, as measured by SAT Math scores, and college STEM success holds for both SAT disclosers and withholders.

Under test-optional admissions policies, colleges have reduced visibility into students' math readiness, particularly among lower-scoring applicants who disproportionately withhold their test scores. SAT Math scores can be useful to facilitate STEM student success and target scarce institutional resources for student supports.

Theme 3: Information on AP STEM coursework complements SAT Math performance in predicting college STEM success.

Among students with lower SAT Math scores, those who participated in three or more STEM APs in high school outperformed their peers with zero STEM APs—3.16 vs. 2.91 on FYGPA, 69% vs. 46% on rate of STEM major persistence, and 42% vs. 17% on rate of on-time bachelor's degree completion in STEM. These gaps across AP STEM experiences are smaller among college STEM majors with higher SAT Math scores, but still present. The on-time STEM degree completion gap among all enrollees is about the same size at higher and lower SAT Math scores. AP STEM participation is readily available on high school transcripts.

Theme 4: Test-optional colleges have the least visibility into STEM students at the greatest risk for poor outcomes.

Because students with lower SAT scores are the least likely to share their scores with colleges, institutions have less visibility into the math readiness of the STEM students who would most likely benefit from additional student supports.

Standardized measures of STEM readiness such as SAT Math scores and STEM AP participation provide colleges with data to support students at greatest risk for poor outcomes in STEM fields.

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The Admissions Research Consortium (ARC)

The Admissions Research Consortium (ARC) is a collaborative research initiative that aims to help participating institutions gain insight into their own and their peers' admissions processes and outcomes, as well as changes in student behavior influenced by the Covid-19 pandemic. Guided by a Core Advisory Committee and a Research Advisory Committee, evidence and insights from ARC inform future practice and policy in the years following the pandemic. This research brief presents data on readiness for and success in college STEM pathways among enrollees admitted under widespread test-optional policies beginning with the fall 2021 entering class. Related new ARC studies examine the latest data on four-year GPA, credit accumulation, and graduation for all enrollees in the fall 2021 entering class (Bloem et al., 2026) and funnel insights through fall 2025 (Edwards et al., 2026).

Background on Math Readiness and College STEM Success

Over the past decade, bachelor's degrees in STEM fields grew by 17% (National Science Board et al., 2026a). Since the start of the pandemic, that growth in STEM degrees has leveled off, raising questions about whether the STEM pipeline can continue to meet workforce demands in technical fields.¹ The Bureau of Labor Statistics projects U.S. labor markets will continue to demand outsized growth in STEM fields relative to non-STEM occupations through at least 2035.²

Math readiness for the STEM pipeline is a central concern. The high school class of 2024 earned the lowest National Assessment of Educational Progress (NAEP) grade 12 math score ever reported (National Center for Education Statistics, 2025), and only one-third were deemed academically prepared for college-level math (National Assessment Governing Board, 2025). U.S. students' math scores on the Programme for International Student Assessment (PISA) were about the same in 2025 as in 2022, remaining below their 2018 level and among the lowest recorded for the United States (Organisation for Economic Co-operation and Development [OECD], 2026). New evidence from campus-based researchers suggests that the number of first-year college students with math skills below a high school level increased dramatically between 2020 and 2025 (UCSD Senate-Administration Workgroup on Admissions, 2026; Horowitch, 2025), leading some colleges to introduce additional foundational or remedial math courses (Healey & Parker, 2024; Horowitch, 2025). The result has been a national conversation about math preparation and proficiency in the U.S. (Aldeman, 2026; Barnum, 2026; Burdman, 2025; Cowen, 2026; Horowitch, 2025; Mervosh, 2025; Schwartz, 2026a, 2026b).

These signals of low and declining math readiness matter because preparation shapes success in college STEM. Among college students who began in a STEM major, 71% of

¹ See degree completion data by discipline are available in this dashboard from National Student Clearinghouse at <https://nscresearchcenter.org/undergraduate-degree-earners/>.

² See latest projections from the Bureau of Labor Statistics are available at https://www.bls.gov/news.release/archives/ecopro_08272026.htm.

those in the top quintile of 11th grade math completed a STEM degree compared to 34% in the bottom quintile (National Science Board, 2026b). Students with lower measured achievement in math face the greatest risk of low grades in first-year college STEM coursework and are more likely to suffer the worst academic outcomes in math courses—Ds, Fs, and course withdrawals (Bloem et al., 2025; Marini et al., 2026; Shaw, 2025). Even among students with the same high school grades, standardized measures like SAT scores provided additional useful information about math and STEM success in the first year of college (Westrick et al., 2023, 2025).

Widespread test-optional admissions policies in place since the pandemic may exacerbate the effect of these concerning math readiness patterns. A study of 22 four-year institutions found that entering students' average SAT Math score was about 20 points lower for the 2021 cohort than for the 2017 cohort (Westrick et al., 2024). Research also shows that college applicants with lower SAT and ACT scores are unlikely to share those low scores with colleges, reducing visibility into math readiness among roughly half of college applicants who are the most likely to need additional math supports (Bloem et al., 2025; Common App, 2025).

This brief examines the relationship between math readiness (measured by SAT Math scores and AP STEM information) and STEM outcomes (majoring in STEM, STEM majors' first-year grades, persistence in STEM majors, and on-time bachelor's degree completion in a STEM field) among the first cohort of college students admitted under test-optional admissions policies.

Data Sample and Definitions

In 2025, ARC institutions shared administrative data on performance, retention, and degree completion for the fall 2021 entering cohort. These data, which also include a robust set of student demographic and academic variables, were merged with College Board assessment data to enable insight into students who disclosed and withheld SAT test scores under widespread test-optional admissions policies brought on by the pandemic. In this brief, we provide evidence on math readiness and student outcomes based on the combined dataset, which covers a sample of 34 selective four-year public and private nonprofit institutions.

This research employs the following terms and definitions:

Enrollees refers to students who enrolled at ARC colleges in the fall following their high school graduation. **Score choice** refers to whether an enrollee disclosed an SAT or ACT score, withheld an SAT score, or had no SAT score on file. **Disclosed SAT/ACT scores** are SAT/ACT scores that students submitted to ARC colleges for consideration in the admissions process. **Withheld SAT scores** are SAT scores that applicants withheld from colleges, but that are observable in College Board administrative data. **No SAT / Withheld ACT scores** refers to students who did not disclose an SAT or ACT score to the ARC institution and do not have a recorded SAT score on file with College Board. These students

may either have an ACT score that they withheld or never took an SAT or ACT assessment.³

First-Year GPA (FYGPA) refers to data provided by participating institutions on the average grades earned by enrollees in their first academic year of college.

STEM Major is defined as one of 11 two-digit Classification of Instructional Programs (CIP) codes: 01 (Agricultural/Animal/Plant/Veterinary Science and Related Fields), 03 (Natural Resources and Conservation), 11 (Computer and Information Sciences and Support Services), 14 (Engineering), 15 (Engineering/Engineering-related Technologies/Technicians), 26 (Biological and Biomedical Sciences), 27 (Mathematics and Statistics), 29 (Military Technologies and Applied Sciences), 40 (Physical Sciences), 41 (Science Technologies/Technicians), 51 (Health Professions and Related Programs).

Year-1 STEM Major refers to students who intended to major in STEM (one of the 11 above CIP codes) in fall of freshman year, at the time of initial enrollment. When this was unavailable from ARC colleges, we supplemented it with the student's year 1 major as indicated by College Board-National Student Clearinghouse linked data and, if still unavailable, from the College Board Student Data Questionnaire.

Year-4 STEM Major is defined as having a year-4 final major (major at the end of the fourth academic year) that is one of the 11 above CIP codes at the initial ARC institution.

Persistence in STEM Major refers to enrollees who were STEM majors in both year 1 and year 4 at the ARC college in which they initially enrolled.

On-Time STEM Bachelor's Degree Completion refers to ARC-college enrollees who graduated in four years at their ARC institution and were STEM majors at the end of the fourth academic year.

SAT Math is the highest score a student earned on the Math section of the SAT, considering both disclosed scores submitted by ARC colleges and College Board administrative data.⁴

AP STEM (also written STEM APs) refers to AP exams a student took from among a set of science- and math-focused AP subjects including biology, chemistry, environmental science, physics (1, 2, C: Mechanics, or C: Electricity and Magnetism), computer science (A or Principles), statistics, precalculus, or calculus (AB or BC), counting any exams taken during high school. **STEM APs offered** refers to whether a student's high school offered at least one AP STEM exam subject (offered) or none (not offered) in the year 2020; it is used to disaggregate students with zero STEM AP exams.

³ Figures 2–9 only include enrollees who are SAT/ACT disclosers or SAT withholders.

⁴ Figures 2–6 display the average outcome for enrollees in one of 12 SAT Math score bands: 200–450, 460–490, 500–530, 540–560, 570–590, 600–620, 630–650, 660–680, 690–710, 720–740, 750–770, and 780–800. Figures 7–9 and A1–A2 use coarser bands of <600, 600–690, and 700–800.

Table 1 summarizes academic preparation and STEM interest among fall 2021 enrollees, overall and by score choice. SAT/ACT score disclosers entered college with stronger measured academic preparation than SAT withholders and students with no SAT score (or who withheld ACT scores). Disclosers' average SAT Math score was 690, compared with 596 among SAT withholders. About 16% of SAT disclosers scored below 600, versus 51% of SAT withholders. Disclosers were also more likely to have at least three STEM AP exams (34% versus 18% of SAT withholders and 10% of students with no SAT score). Disclosers were also more likely to be STEM majors in their first year of college.

Table 1: Characteristics of Fall 2021 Enrollees, by Score Choice

Characteristic	All 2021 Enrollees	SAT/ACT Disclosers	SAT Withholders	No SAT / Withheld ACT
Sample Composition				
Number of students	96,286	62,068	18,211	16,007
Percent of 2021 enrollees	100.0%	64.5%	18.9%	16.6%
Percent Year-1 STEM majors	49.6%	53.8%	43.6%	39.6%
Academic Preparation				
Mean high school GPA	3.89	3.93	3.84	3.81
Mean SAT Math score	662	690	596	—
Percent with SAT Math below 600	26.5%	15.7%	50.9%	—
STEM AP Participation				
Percent with 0 STEM APs when offered	29.8%	24.2%	35.9%	44.5%
Percent with 0 STEM APs when not offered	9.7%	8.1%	8.2%	17.5%
Percent with 1 STEM AP	19.2%	18.4%	22.8%	18.0%
Percent with 2 STEM APs	14.6%	15.6%	15.1%	10.1%
Percent with 3+ STEM APs	26.8%	33.7%	18.0%	9.9%

Note: Descriptive statistics are based on all fall 2021 enrollees with available data for each measure. Shares by score choice therefore differ slightly from Figure 1, which excludes students with missing year-4 STEM major status. The No SAT / Withheld ACT category includes students without an observed SAT score and may include students who withheld an ACT score.

Results

Figure 1 shows that the percentage of enrollees at ARC institutions who majored in STEM fields in year 4 was stable around 47% between fall 2018 and fall 2021 entering cohorts. Under test-optional policies that began for the fall 2021 entering cohort, applicants who disclosed their SAT or ACT scores majored in STEM in the fourth year of college at higher rates (52.4%) compared to SAT withholders (39.3%) and students with no SAT score or ACT withholders (34.2%). Fall 2021 differences in STEM majoring by score choice likely reflect the fact that score disclosers are academically stronger than non-disclosers, in terms of SAT, AP, and high school GPA (Bloem et al., 2025; see also Table 1).

Figure 1: Percent Majoring in STEM at Year 4, Fall 2018 to Fall 2021 Entering Cohorts

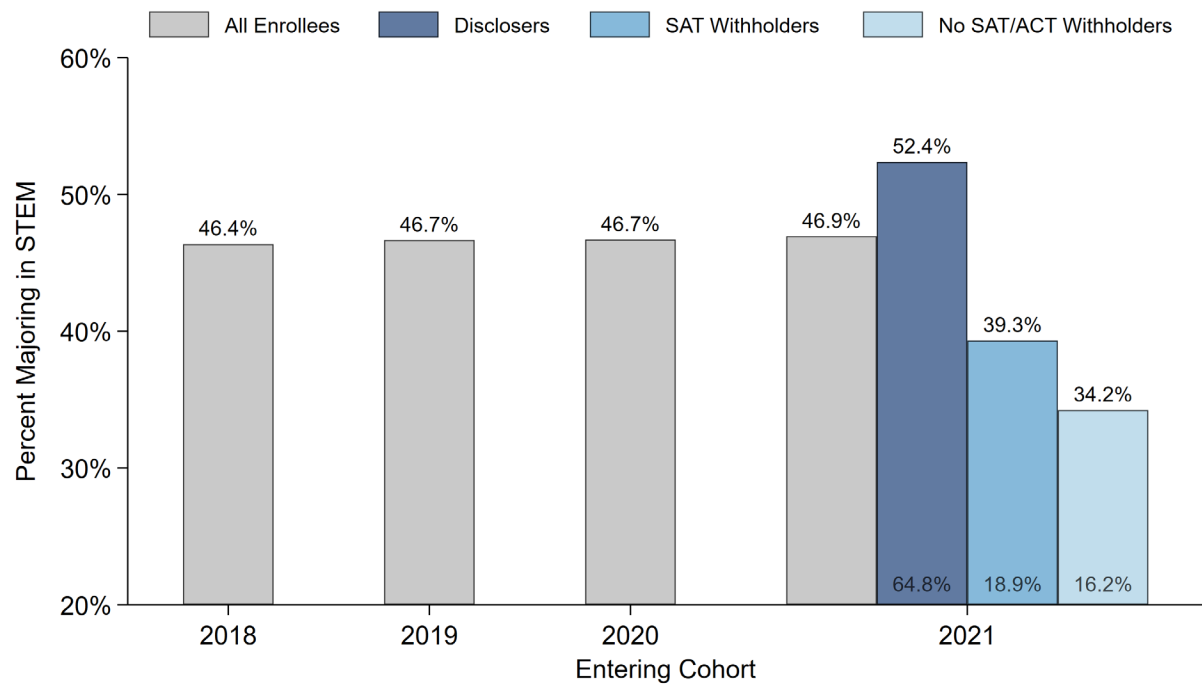
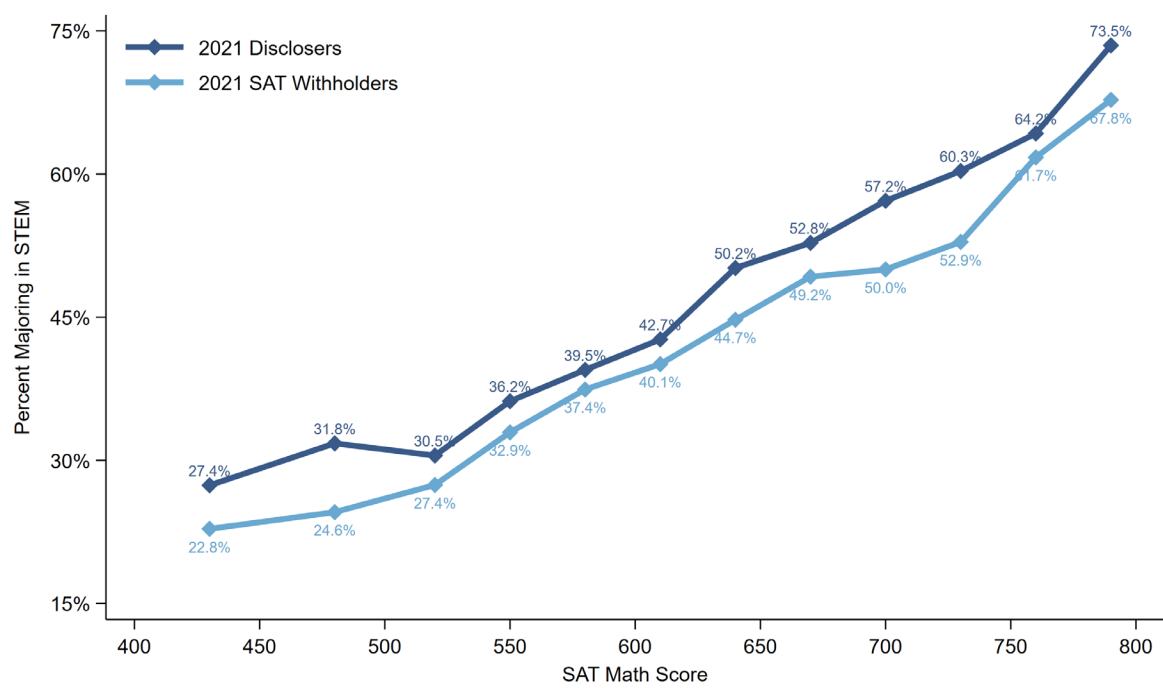


Figure 2 shows that majoring in STEM in year 4 is positively related to SAT Math scores for the first cohort admitted under test-optional policies. The positive relationship between math readiness, as measured by SAT Math scores, and STEM majoring is present for both SAT/ACT disclosers and SAT withholders. Among enrollees with the same SAT Math score, disclosers are slightly more likely to major in STEM than withholders.

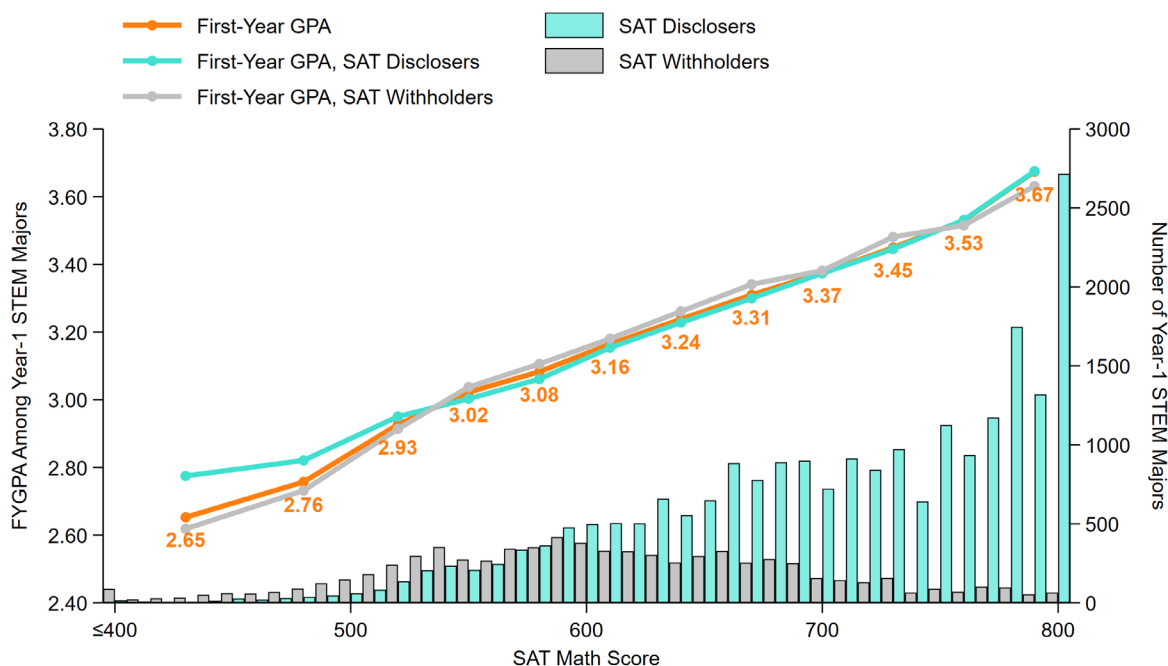
Figure 2: Percent Majoring in STEM at Year 4, Fall 2021 Entering Cohort



Math Readiness and First-Year GPA Among STEM Majors

Figure 3 shows that Year-1 STEM majors with lower SAT Math scores have lower FYGPAs and are predominantly score withholders. Year-1 STEM students with SAT Math scores below 500 have FYGPAs below 3.0. Prior ARC research demonstrates that academic risk increases more rapidly as SAT scores fall in STEM coursework relative to non-STEM coursework (Bloem et al., 2025). Figure 3 also reveals that, among STEM majors with lower math readiness, those who disclosed their SAT scores had higher FYGPAs than SAT withholders with the same SAT Math scores.

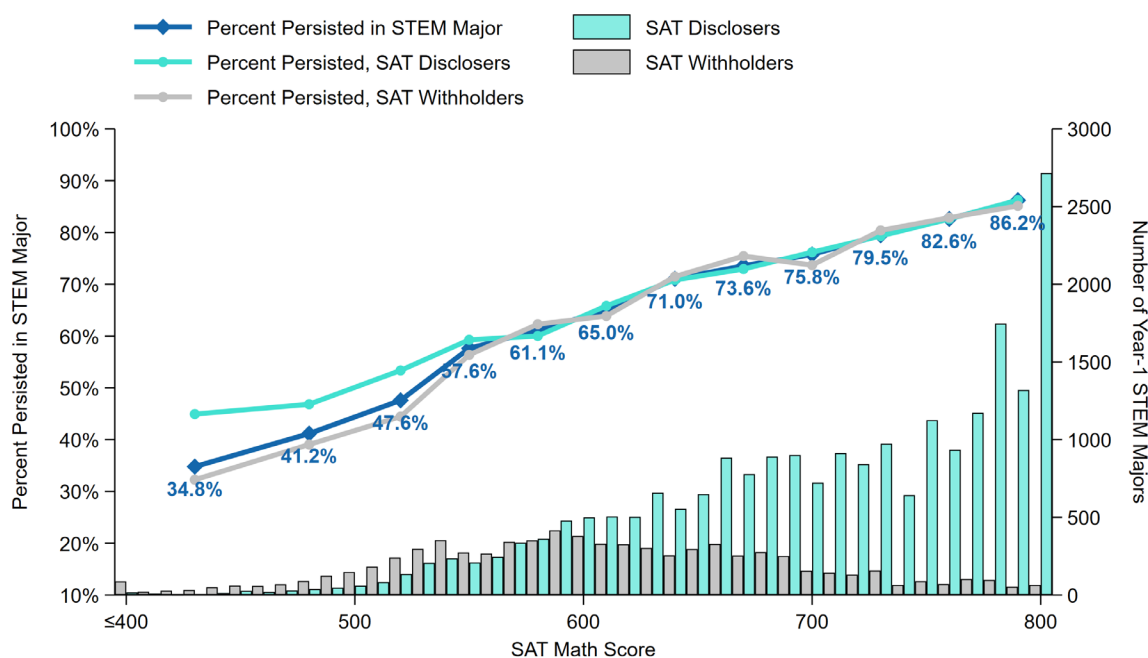
Figure 3: First-Year GPA Among Year-1 STEM Majors, Fall 2021 Entering Cohort



Math Readiness and Persistence in STEM Majors

Figure 4 shows that first-year STEM majors with higher SAT Math scores are more likely to persist in their STEM majors. Those with the lowest SAT Math scores have STEM major persistence rates nearly 50 percentage points below those with the highest SAT Math scores (35% vs. 86%). Figure 4 also reveals that among STEM majors with lower SAT Math scores, those who disclosed their SAT scores had higher rates of persistence in the STEM major than SAT withholders with the same SAT Math scores. Because lower-scoring students are less likely to disclose their test scores to colleges, institutions have less ability to predict STEM major attrition at the point of enrollment.

Figure 4: Persistence to Year-4 STEM Major Among Year-1 STEM Majors, Fall 2021 Entering Cohort

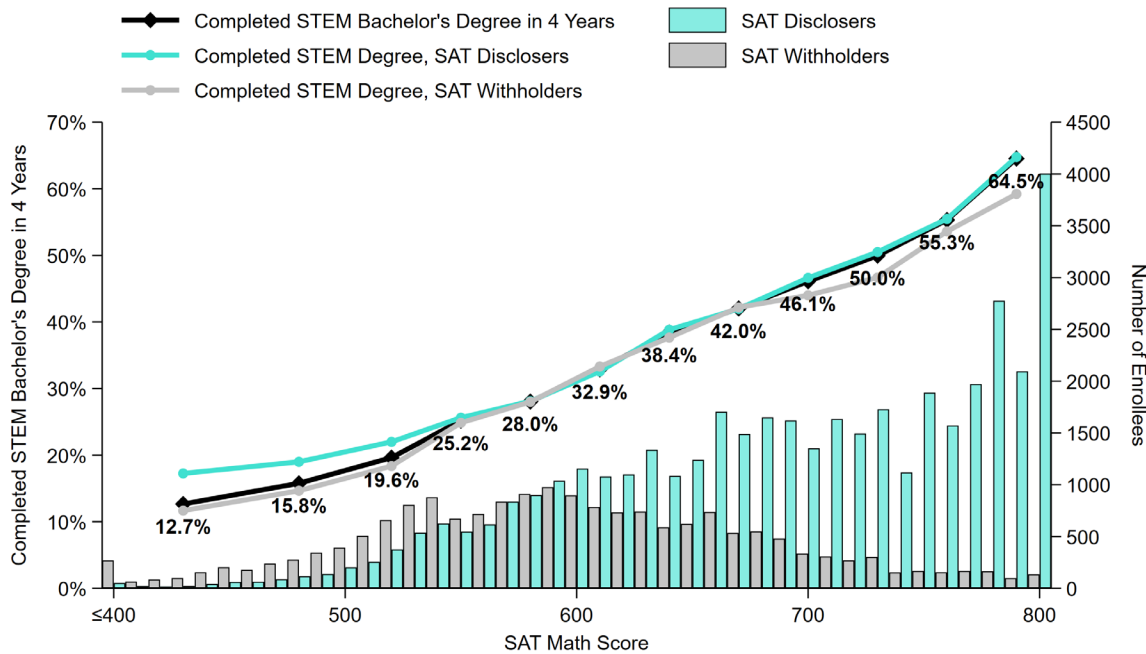


Note: Students who were classified by their ARC college as no longer enrolled by Year 4 were counted as not persisting in STEM to Year 4.

Math Readiness and On-Time Completion of STEM Bachelor's Degrees

Figure 5 shows that students with higher SAT Math scores are more likely to complete bachelor's degrees in STEM within four years than students with lower SAT Math scores. For example, in the fall 2021 entering cohort, while 13% of enrollees in the lowest SAT Math score band graduated as a STEM major in four years, nearly two-thirds of students in the highest SAT Math score band did so. Figure 5 also reveals that at both ends of the SAT Math distribution, students who disclosed their SAT scores had higher rates of on-time STEM bachelor's degree completion than SAT withholders with the same SAT Math scores, with the largest difference observed among students with lower math readiness. Because lower-scoring students are less likely to disclose their test scores to colleges, institutions have less ability to predict STEM non-completion or longer time-to-degree at the point of enrollment. The pattern observed in Figure 5 is consistent with recent evidence that test-optional policies can reduce the share of bachelor's degree completion in STEM fields (Lewis, 2026).

Figure 5: Percent of Fall 2021 Entering Cohort Completing a Bachelor's Degree in STEM in Four Years

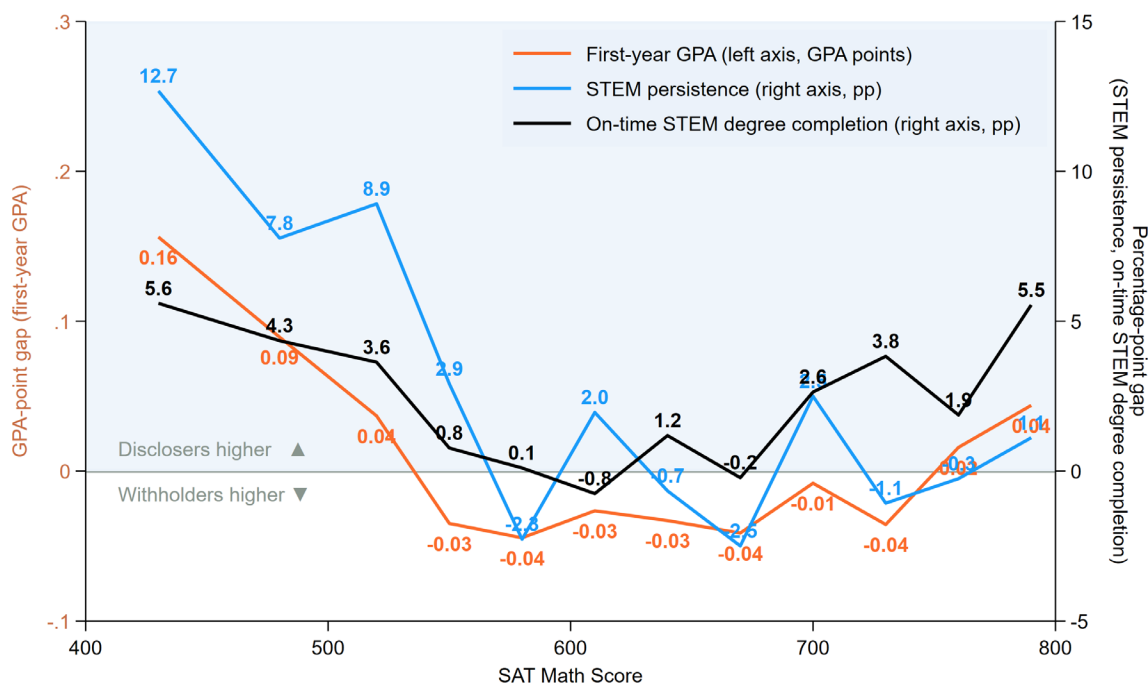


Note: Figure 5 focuses on the share of all students in the fall 2021 entering cohort completing a degree in STEM. Appendix Figures A1 and A2 contain additional detail on the outcomes of the fall 2021 entering cohort and of Year-1 STEM majors four years after first enrollment.

Math Readiness Information from SAT and AP

Figures 3, 4, and 5 demonstrate the strong relationship between math readiness as measured by the SAT and college STEM outcomes. Even among students with similar SAT Math scores, however, we observe some differences in college STEM outcomes between those who disclose their SAT scores and those who withhold them. Figure 6 clarifies that these differences in STEM outcomes by score choice are more prominent at the lower end of the SAT Math distribution. For example, for students with SAT Math scores below 500, STEM students who disclose their SAT scores have higher FYGPAs (by 0.09–0.16 points), higher rates of persistence in STEM majors (by 8–13 percentage points), and, among all enrollees, higher rates of STEM degree completion in four years (by 4–6 percentage points) than those who withhold their scores.

Figure 6: Differences in College STEM Outcomes Between SAT Score Disclosers and Withholders, by SAT Math Score, Fall 2021 Entering Cohort



Note: Each line shows the difference in group means (disclosers minus withholders) for one outcome at each SAT Math band. First-year GPA is in GPA points and persistence in STEM major is in percentage points, both among Year-1 STEM majors. On-time STEM degree completion is in percentage points among all enrollees. Positive values mean disclosers have the higher average for the relevant outcome.

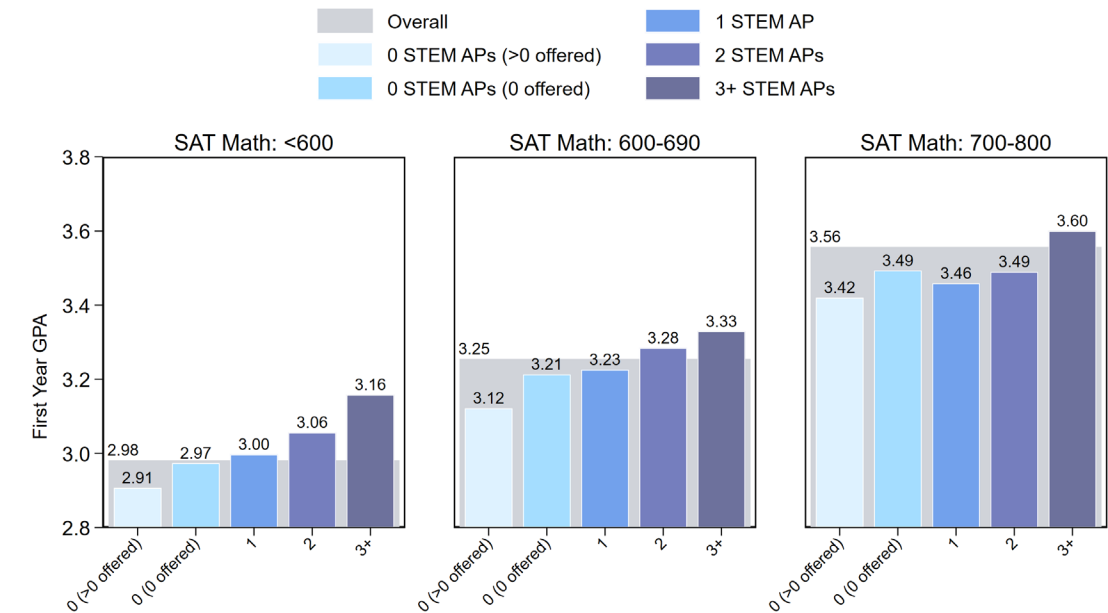
The pattern observed in Figure 6 suggests that there may be other factors related to SAT score disclosure that are also positively related to college STEM success. Given that college admissions professionals utilize multiple measures to assess student readiness for the institution and specific majors, we explore whether information on students' participation in AP STEM coursework in high school provides additional insight into these differences in college STEM success among students with lower SAT Math scores.

Figures 7 to 9 consider both SAT Math scores and AP STEM participation simultaneously. Each panel shows one SAT Math range, and the bars within it show the outcome by number of STEM AP exams taken, from zero to three or more; students with zero exams appear in two bars, depending on whether their high school offered STEM AP exams (>0 offered) or did not (0 offered).

Figure 7 shows how first-year GPA among STEM majors varies across SAT Math scores and number of STEM AP exams taken during high school. The first panel of Figure 7 shows that college Year-1 STEM majors with SAT Math scores below 600 have an average FYGPA of 2.98. Consistent with Ackerman et al. (2013), additional data on participation in AP STEM courses in high school (in blue bars) provides useful information about first-year

performance in STEM. Lower SAT Math scorers who took zero STEM APs (but had APs available in their high school) earned average FYGPAs of 2.91 compared to 3.16 among similar students who took three or more STEM APs. Although the stair-step pattern in STEM APs' relationship with FYGPA is strongest for lower-SAT Math students in the first panel of Figure 7, the second and third panels of Figure 7 also demonstrate that Year-1 STEM majors who took three or more STEM APs in high school outperform their peers who took zero STEM APs by roughly 0.20 GPA points.

Figure 7: FYGPA Among Year-1 STEM Majors by SAT Math Score and AP STEM Participation, Fall 2021 Entering Cohort

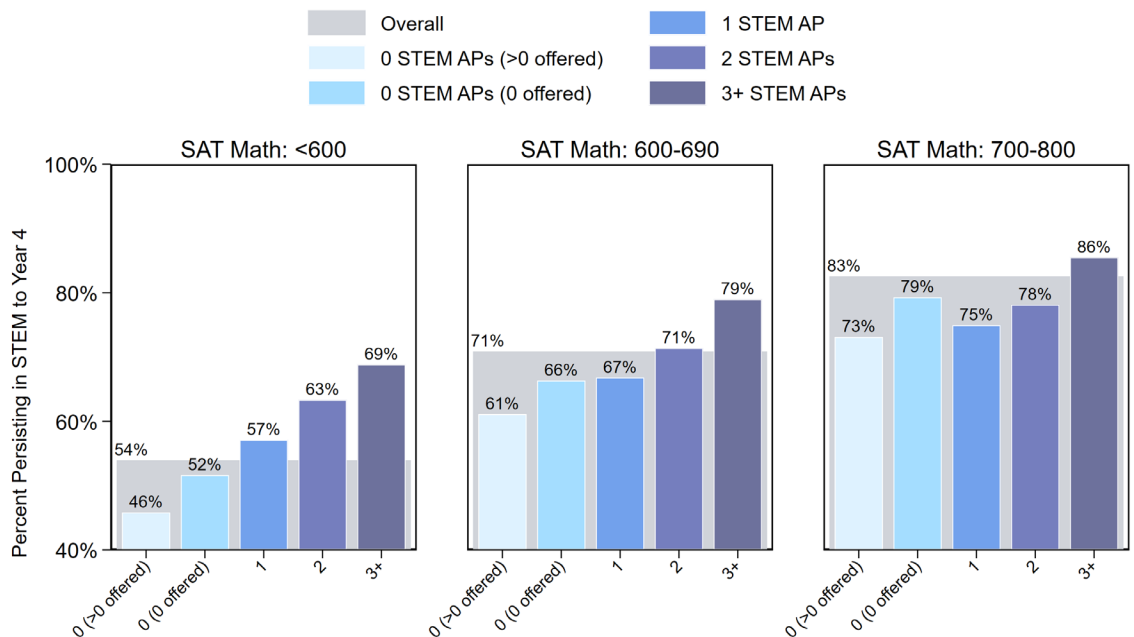


Note: The gray “Overall” band shows the average first-year GPA for all Year-1 STEM majors in each SAT Math range, regardless of AP STEM participation.

Figure 8 shows that among STEM majors with similar SAT Math scores, students who took more STEM APs are substantially more likely to persist in STEM majors than students who took zero STEM APs, consistent with earlier research (Shaw & Barbuti, 2010). STEM major persistence rates are more than 20 percentage points higher for lower-SAT Math (<600) students with three or more STEM APs compared to zero STEM APs. The persistence gap narrows as SAT Math scores rise but remains at 13–18 percentage points for students scoring 600 or higher.

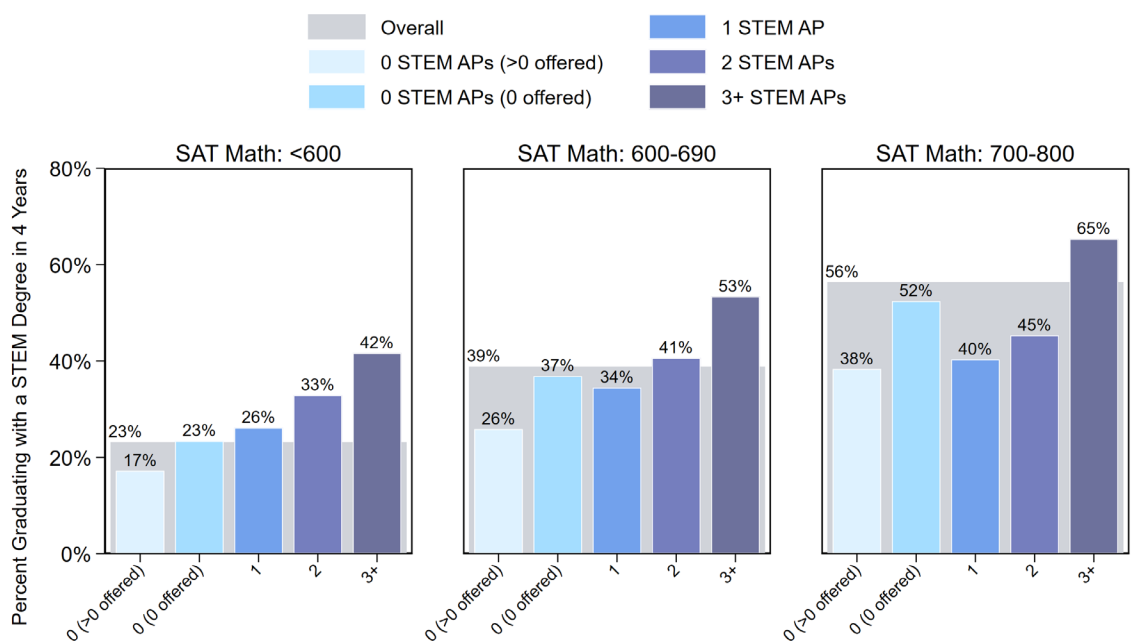
Figure 9 demonstrates that patterns related to STEM APs carry through to degree completion. In all three SAT Math score groups, students with three or more STEM APs in high school are roughly 25 percentage points more likely to complete STEM degrees in four years than peers with similar SAT Math scores who took zero STEM APs. For students with lower math readiness on the SAT, or for whom institutions lack visibility into their math readiness due to score choice, participation in STEM APs provides an additional strong signal about on-time degree completion.

Figure 8: Persistence to Year-4 STEM Major Among Year-1 STEM Majors by SAT Math Score and AP STEM Participation, Fall 2021 Entering Cohort



Note: The gray "Overall" band shows the average persistence in STEM for all Year-1 STEM majors in each SAT Math range, regardless of AP STEM participation.

Figure 9: Percent of Fall 2021 Entering Cohort Completing a Bachelor's Degree in STEM in Four Years, by SAT Math Score and STEM AP Participation



Note: The gray "Overall" band shows the average on-time completion rate of Bachelor's degrees in STEM for all students in each SAT Math range, regardless of AP STEM participation.

Conclusion

SAT Math scores and AP STEM participation each predict how students perform and persist in STEM majors and complete bachelor's degrees on time. In the first test-optional cohort, higher SAT Math scores align with higher first-year GPAs, higher persistence, and higher four-year completion rates for STEM students, for both SAT score disclosers and withholders. AP STEM participation adds useful information about college STEM outcomes among students with similar SAT Math scores, particularly for first-year GPA and persistence among STEM students with weaker SAT Math performance.

The evidence has several potential implications for policy and practice. First, SAT Math scores can help identify students at risk of failing or withdrawing from first-year college math, adding predictive information beyond high school grades (Marini et al., 2026). Second, for institutions with test-optional admissions policies and less access to SAT Math scores, AP STEM participation can provide colleges additional information needed for placing, advising, and supporting incoming STEM students, especially because score withholders are disproportionately represented among students with lower measured math readiness, where risks of poor STEM outcomes are greatest. Collecting SAT scores and utilizing AP STEM information on high school transcripts or via tools that allow users to examine AP results by exam and school for recent high school cohorts can help ensure that students with these signals of lower math readiness receive early supports to avoid weak first-year grades, major switching, and longer time-to-degree. Finally, test-optional admissions policies do not eliminate differences in students' math readiness; they can make those differences less visible to institutions. This study focuses on outcomes of the fall 2021 entering cohort. Later cohorts experienced more disruption in learning in high school. We will continue to study the impact of math readiness on students' college academic outcomes, including success in STEM.

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Appendix

**Figure A1: Year-4 Outcomes by SAT Math and Score Choice, Fall 2021
Entering Cohort**

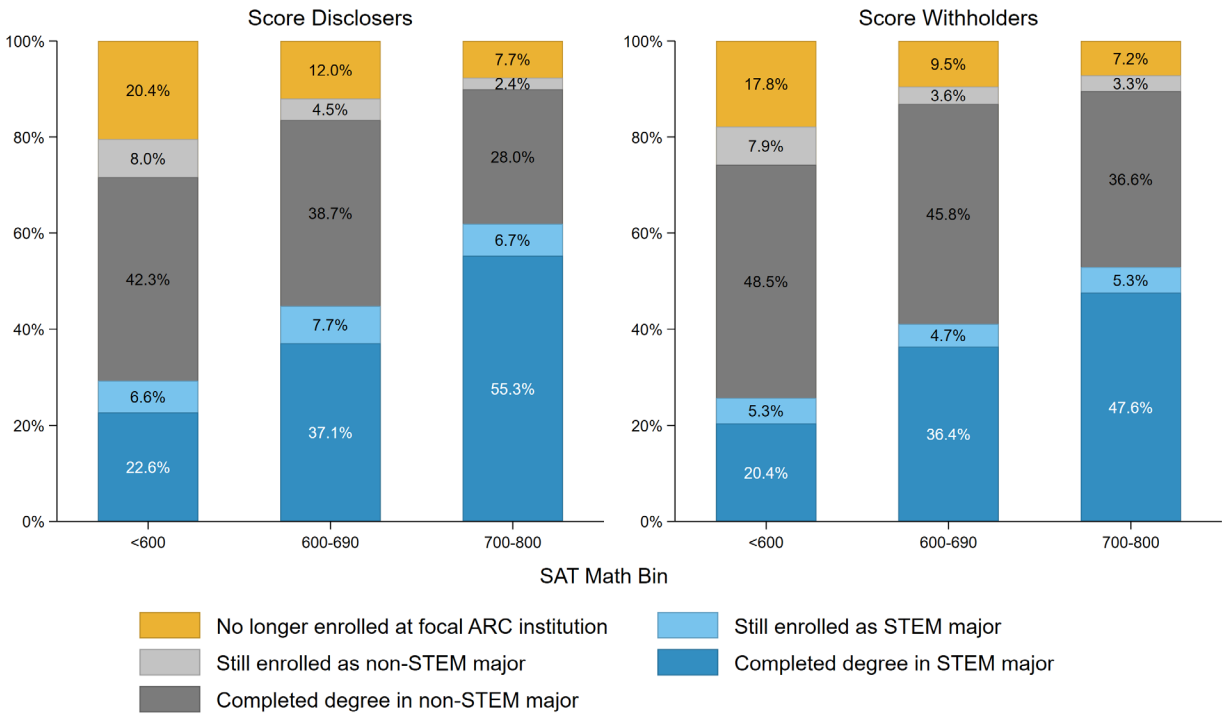
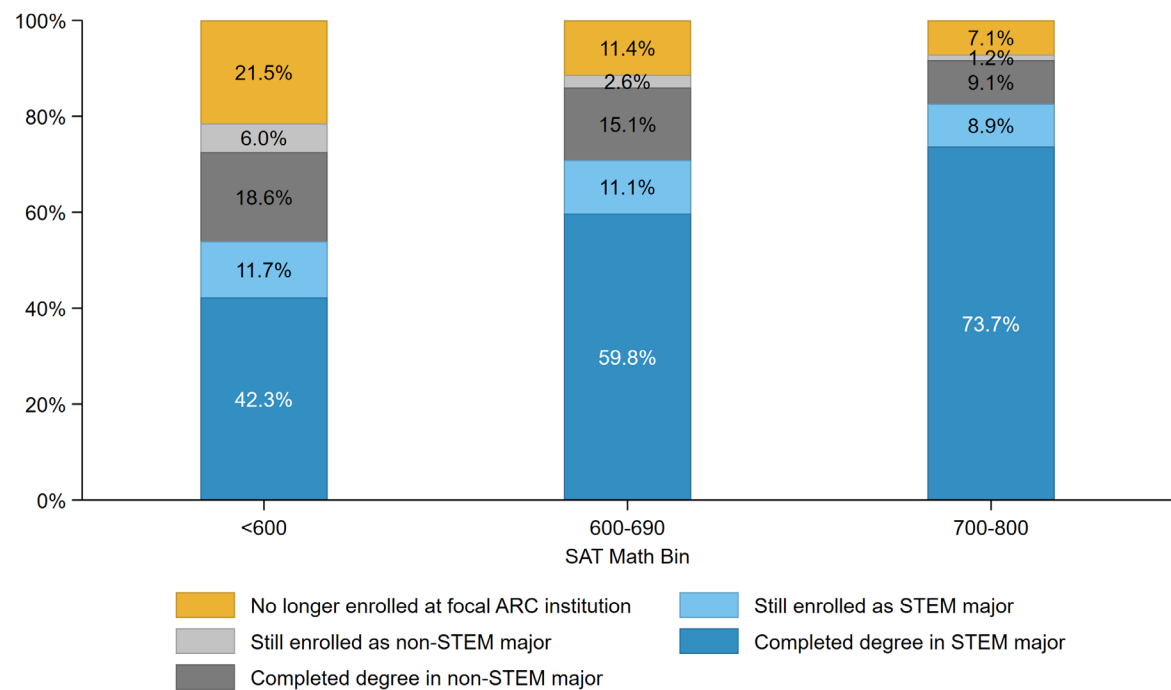


Figure A2: Year-4 Outcomes by SAT Math Among Year-1 STEM Majors, Fall 2021 Entering Cohort



About the College Board

The College Board is a mission-driven not-for-profit organization that connects students to college success and opportunity. Founded in 1900, the College Board was created to expand access to higher education. Today, the membership association is made up of over 6,000 of the world's leading educational institutions and is dedicated to promoting excellence and equity in education. Each year, the College Board helps more than seven million students prepare for a successful transition to college through programs and services in college readiness and college success — including the SAT® and the Advanced Placement Program®. The organization also serves the education community through research and advocacy on behalf of students, educators and schools. For further information, visit www.collegeboard.org.

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