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The Development of an Index of Academic Rigor for College Readiness

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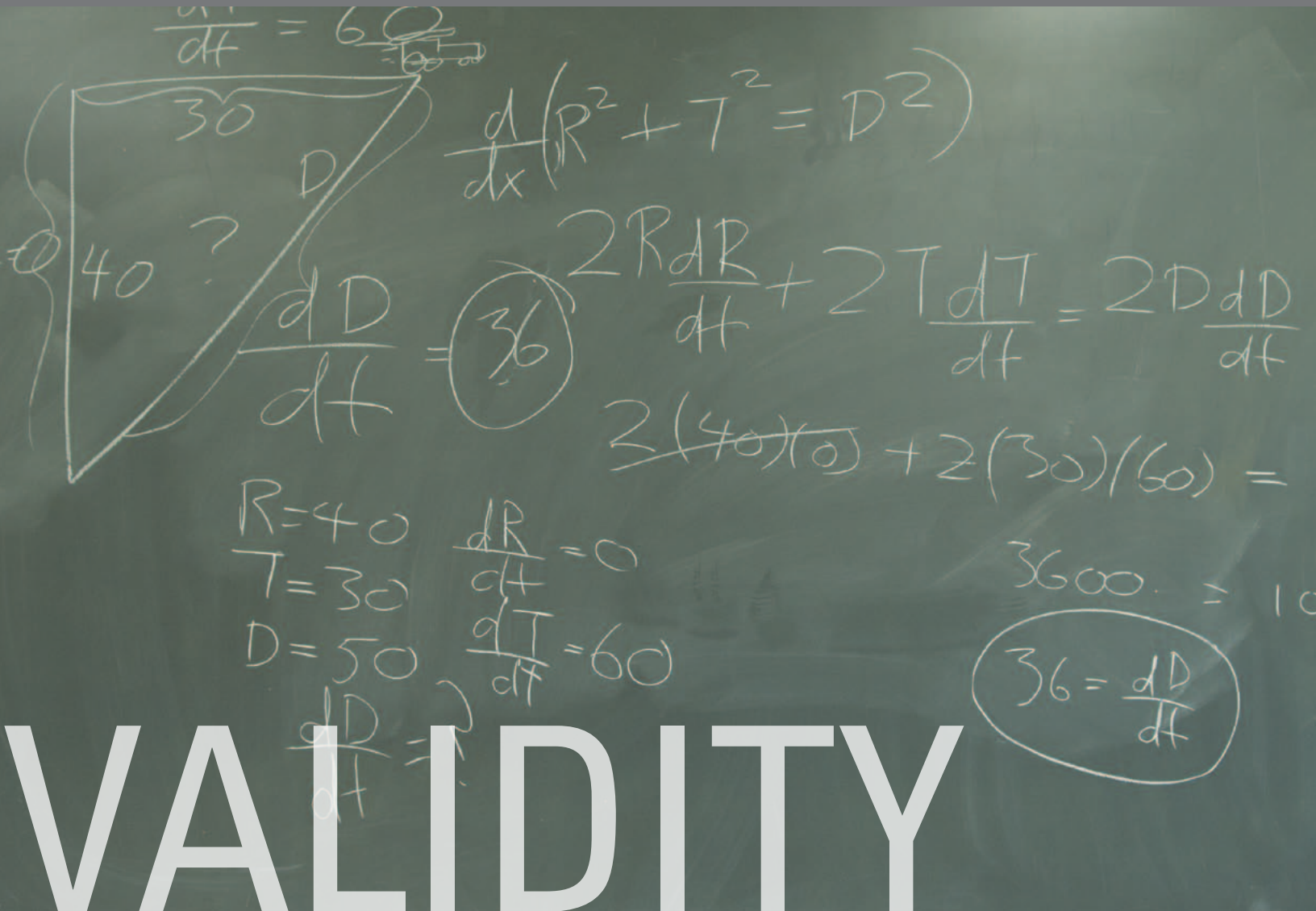

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Executive Summary

Academic intensity or academic rigor of students' high school curriculum is positively related to several college outcomes including the avoidance of remediation and graduation attainment (Adelman, 1999, 2006; Adelman, Daniel, & Berkovits, 2003). However, research on academic rigor has been limited possibly due to the difficulty in obtaining a quantitative measure applicable across schools and districts. This study is an attempt to create an index of academic rigor using self-reported course work data that would assist in providing information on the academic preparation of over one million graduating high school seniors each year.

The current study uses the SAT® Questionnaire (SAT-Q) that students complete when registering for the SAT exam to construct an academic rigor index (ARI). The SAT-Q asks students detailed questions on English, math, science, social science/history, and foreign/classical language course work completed during high school. The relationship between course participation and first-year GPA (FYGPA) was investigated using approximately 68,000 SAT takers students who fully completed the SAT-Q and attended one of the 110 four-year colleges and universities participating in an SAT validity study. Based on this data, the ARI was constructed on a 0-25 scale equally weighted between each of the five subject areas. Once the ARI was constructed a series of analyses were conducted to assess the relationship between the index and other concurrent measures of high school performance (HSGPA and SAT scores) and between the index and measures of college performance (enrollment, grades, and retention). The results indicated that students who took more rigorous courses in high school attained better grades, achieved higher SAT scores, and were more likely to enroll in college. Moreover, these students were also more likely to matriculate to a four-year college, attain higher college grades, and be retained to their second year.

Introduction

The Importance of Academic Rigor

Graduation from college has been associated with a wide variety of positive financial and societal outcomes (Baum & Ma, 2007; Organisation for Economic Co-operation and Development [OECD], 2009). Unfortunately, the United States has seen its relative standing in college graduation rates decline over the last decade. The United States was ranked second in the percentage of students who received a tertiary degree (postsecondary program which includes two-year and four-year colleges) in 1995, but fell to 15th among 25 countries in 2005 (OECD, 2010). The National Center for Higher Education Management Systems (NCHEMS) estimates that 39% of adults ages 25 to 34 in the United States have an associate degree or higher (www.higheredinfo.org). While this percentage is higher than that of a number of countries, it is notably lower than that of others, such as Canada, Japan, and Korea, all of whom have more than half of their comparable adults holding an associate degree or higher. As a result of the nation's relative decline in educational attainment, President Barack Obama set a goal for the United States to have the highest proportion of college graduates in the world by 2020 (http://www.whitehouse.gov/issues/education).

One of the elements of the administration's efforts to increase the college graduation rate is to advocate higher academic standards in the nation's high schools. Some research has suggested that many high school curricula are not rigorous enough to adequately prepare students for college success, and that meeting state standards for high school graduation may not adequately prepare students for college-level course work (American Diploma Project, 2004). While 26 states require students to pass an exam before certifying them as high school graduates, some of these tests only measure 8th- to 10th-grade skills. At the time of this report, only 10 states have testing systems that address whether students have mastered the knowledge and skills required for successful performance in college (American Diploma Project, 2004).

Unsurprisingly, many high school graduates do not possess the requisite knowledge for college-level work. College professors estimate that 42% of students are not adequately prepared for college, and 70% of college instructors report having to devote some of their first-year class time toward reviewing content that they feel should have been taught in high school. Only 28% of college instructors believe that public high schools adequately prepare students for the challenges of college (Achieve, 2005). Similarly, Conley (2007) argued that high school often does not adequately prepare students with the skills required of college-level courses, which are generally faster paced and require students to engage in more high-level tasks. The requisite skills can include drawing inferences, interpreting results, analyzing conflicting sources of information, supporting arguments with evidence, and thinking deeply about material.

Unprepared college students may find themselves in need of remediation. Nationally, approximately 28% of incoming first-year students take remedial course work (Wirt, Choy, Rooney, Provasnik, Sen, & Tobin, 2004). Although enrolling in remedial courses often allows students to earn institutional credits that maintain full-time status, financial aid eligibility, and qualifications for campus housing, these credits do not count toward graduation. Parsad, Lewis, and Greene (2003) estimated that 73% to 78% of institutions award institutional credit for remedial reading, math, or writing courses. This may lengthen the time required to obtain a degree, or increase pressure on financial resources and possibly contribute to markedly lower graduation rates among remediated students. Approximately 69% of 12th-graders who enrolled in postsecondary education and avoided remediation graduated with a certificate,

associate degree, or bachelor's degree. In comparison, the graduation rates for students who required remediation is between 30% and 57%. Among students who attended postsecondary institutions, 58% of nonremediated students obtained a bachelor's degree, compared to between 17% and 37% of remediated students, depending on the type and intensity of remedial course work (Wirt et al., 2004).

Adelman, Daniel, and Berkovits (2003) found a negative relationship between the level of rigor experienced in high school and remediation in college. Adelman et al. divided the academic intensity of a student's curriculum into quintiles and found that 15% of students in the highest quintile needed remediation, compared to 36% in the second quintile, 53% to 54% in both the third and fourth quintiles, and 67% in the bottom quintile.

Other research has demonstrated that participation in a rigorous high school curriculum is linked to positive educational outcomes, such as performance on standardized measures of achievement. Bridgeman, Pollack, and Burton (2004) reported a relationship between the level of academic intensity or rigor and performance on the SAT. Milewski and Sawtell (2006) found a similar relationship, and reported a multiple correlation of .62 between the authors' academic intensity variable and PSAT/NMSQT® scores.

Other research has suggested that academic preparation is a good predictor of college graduation, with rigorous and intense classes being a critical component of academic preparation, particularly in mathematics. Adelman (2006) reported that 83.3% of 12th-graders who had taken (or were taking) a calculus course in 1992 graduated with a bachelor's degree by 2000. For those whose most advanced course was precalculus, 74.6% graduated, compared to 60% for trigonometry and 39.9% for algebra II.

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Adelman (1999) also found that the impact of a rigorous curriculum was even greater for African American and Hispanic students than for white students. White students who advanced beyond Algebra II had Bachelor's degree completion rates 10.4% higher than did white students overall. However, African American and Hispanic students progressing beyond Algebra II had improved degree completion rates of 27.5% and 18.5% respectively, considerably higher than that of white students.

There is also some evidence that suggests that students would be willing to work more diligently in high school if higher academic standards were in place. Approximately 82% of college students in a recent survey indicated that they would have worked harder if the standards necessary to earn a diploma had been higher (Achieve, 2005). Additionally, 62% of college students said they would have taken more challenging courses in at least one academic area had they known about the expectations of college. Those who experienced high expectations in high school were more than twice as likely to feel well prepared for college and obtain mostly A's, and were about half as likely to take a remedial course (Achieve, 2005)

Research Defining College Readiness

Against this backdrop, many organizations are defining college readiness. While these standards vary greatly in focus, scope, and ease of attainment, many consider academic rigor to be a core component. The National Center for Education Statistics (NCES) constructed a measure of college readiness based on cumulative grades in high school, academic course work, senior class rank, National Education Longitudinal Study (NELS) 1992 test scores, and SAT and ACT college entrance examination scores (Berkner & Chavez, 1997). Subject-matter experts were used to create five levels of college readiness, ranging from marginally or not qualified to very highly qualified. In a step that emphasized the importance of a rigorous curriculum, students were moved up one category for completing certain academic courses and moved down one level otherwise.

Greene and Winters (2005) proposed a college readiness standard that required students to meet or exceed the requirements of three independent screens. One screen or requirement for college readiness was graduation from high school, and another was demonstrating basic reading skills through an assessment like NAEP. The final screen is that the student must have a minimum number of classes in critical content areas. Greene and Winters defined these class requirements as four years of English, three years of math, and two years each of natural science, social science, and foreign language.

Some other organizations have taken an approach that emphasizes content standards as a means of preparing students for college. One of the largest undertakings is the Common Core State Standards Initiative, which is being led by the National Governors Association Center for Best Practices (NGA Center) and the Council of Chief State School Officers (CCSSO). The Standards were designed to be aligned with college and work expectations, and include rigorous content and the application of knowledge using higher-order skills. High school students completing a curriculum based on these standards should be prepared to succeed in credit-bearing college courses or work force training (Common Core State Standards Initiative, n.d.).

Another initiative is being led by the Texas Education Agency (TEA), which established a series of content standards in the areas of English language arts, social sciences, mathematics, and natural sciences (Texas Education Agency, n.d.). These content standards were designed to encourage deeper-level thinking and prepare students for the academic challenges typically faced in college courses. The Texas Higher Education Coordinating Board suggests a "recommended high school program" (RHSP) to meet college readiness goals that include four credits in English language arts; four credits in math, including algebra II; four credits in science, including biology, chemistry, and either physics or principles of technology; four credits in social science; and two credits in foreign language.

The American Diploma Project, launched by Achieve with more than 35 participating states, has developed a set of English and math benchmarks designed to prepare students for college (American Diploma Project, 2004). These benchmarks emphasize skills that high school students should possess at the time of graduation and are considered to be more rigorous than many current state standards. One goal of these standards is to encourage schools, districts, and states to reevaluate the content and rigor of their curricula and provide courses that prepare students to meet or exceed the college readiness benchmarks.

The College Board's Approach to Measuring Academic Rigor

Academic rigor is increasingly being recognized as an essential component of college readiness. While the importance and value of academic rigor continues to be stressed, there are few, if any, scales developed that allow for the measurement of student academic rigor. This report is designed to introduce an academic rigor index (ARI) that was developed for SAT students and allows for the evaluation of the rigor of a student's course work both within and across specific disciplines. This report has two sections: Phase one of the report describes how the ARI was developed and the criteria used during this development. Phase two investigates the relationship between the ARI and various educational outcomes, such as college attendance, persistence, FYGPA, and concurrent measures of high school performance.

While the importance and value of academic rigor continues to be stressed, there are few, if any, scales developed that allow for the measurement of student academic rigor.

Phase One: Calculation of the Academic Rigor Index (ARI)

Method

Data

The primary sample used in the creation of the ARI was the SAT higher education validity (HEV) sample, which included data on SAT performance and first-year college performance for students who had graduated from high school in 2007. The HEV sample was created through collaboration between the College Board and a group of four-year colleges and universities. Universities were recruited by the College Board and asked to provide first-year GPA (FYGPA) and course work data to the College Board as part of an initiative to collect data that could be used to evaluate the validity and fairness of the SAT.

The population was defined as the universe of four-year institutions that received SAT scores from at least 200 unique students in 2005. Using this definition, 726 four-year universities were identified and classified as the population whose key characteristics were used to create a representative sample. After recruitment was finished, 110 four-year institutions submitted data to the College Board for their entering class of 2007.

Table 1 provides a comparison of the target population to the study sample in terms of location (region), admission selectivity, size, and control (public or nonpublic). The institutions in the sample were fairly representative, geographically, although slightly overweighted with schools from the Northeast and the Mid-Atlantic states and underweighted with schools from the South. Additionally, schools in the sample were slightly more selective and more likely to be privately controlled than those in the population.

Table 1

Percentage of Institutions by Key Variables: Comparison of Population to Sample of Institutions

Variable	Class	Population	Sample	Sample N
Region of U.S.	Midwest	16%	16%	18
	Mid-Atlantic	18%	21%	23
	New England	13%	18%	20
	South	25%	14%	15
	Southwest	10%	13%	14
	West	18%	18%	20
Selectivity	Admits under 50%	20%	19%	21
	Admits 50% to 75%	44%	57%	63
	Admits over 75%	36%	24%	26
Size	Small	18%	22%	24
	Medium to large	43%	37%	41
	Large	20%	17%	19
	Very large	19%	24%	26
Control	Public	57%	46%	51
	Private	43%	54%	59

College Board data on students who completed the SAT and graduated from high school in 2007 was matched to college and university records from the 110 participating institutions. All students who take the SAT are asked to complete the SAT Questionnaire when registering for the test. This questionnaire collects information on students' demographics, college preferences, and high school performance, including HSGPA and course work. In the summer of 2006, the College Board modified the SAT Questionnaire to collect more detailed records of student course-taking patterns in high school. The revised questionnaire asked students to indicate which courses they had completed (or were planning to complete) in each grade, as well as whether the course was an honors, dual enrollment, or AP® class. Data from this revised questionnaire were used to calculate the (ARI). The questionnaire items on course work can be found in Appendix A. The number of graduating seniors in the original HEV sample was 159,283. These students were scheduled to graduate in 2007, completed the SAT, reported their HSGPA, and had a FYGPA provided by one of these 110 institutions. Approximately 70% of these students (N = 112,740) had been given the opportunity to complete the revised SAT Questionnaire. This sample (112,740 students) was further restricted to those students who had fully completed the section on course work, resulting in 67,644 students in the final HEV sample.

Table 2

Demographic Characteristics of the HEV Sample and the Population[1]

Variable	Class	Original HEV		Final Hev		Population	
		Number	Percent	Number	Percent	Number	Percent
Gender	Female	86,390	54%	39,189	58%	620,580	56%
	Male	72,893	46%	28,455	42%	496,048	44%
Race/Ethnicity	American Indian	823	1%	358	1%	6,657	1%
	African American	10,224	9%	5,796	9%	140,442	13%
	Asian American	14,555	6%	6,809	10%	98,798	9%
	Hispanic	12,934	8%	6,951	10%	152,968	14%
	White	109,150	69%	43,130	64%	662,683	59%
	Other	4,480	3%	1,908	3%	32,441	3%
	No Response	7,117	4%	2,692	4%	22,639	2%
Best Language	English	147,114	92%	61,503	91%	986,714	88%
	English & Another	8,521	5%	4,594	7%	103,776	9%
	Another	1,556	1%	732	1%	18,891	2%
	No Response	2,092	1%	815	1%	7,247	1%

Table 2 compares the demographic characteristics of the original HEV sample to the final HEV sample restricted to students who provided course work data and to the population. The Final HEV sample of 67,644 students was 58% female and 42% male — slightly overweighed for females with respect to both the original HEV sample and the population. Relative to the population, the final HEV sample was slightly overweighed for white students and slightly underweighted for African American and Hispanic students. With respect to race/ethnicity, the final HEV sample was slightly more representative than the original HEV sample. More than nine out of 10 (91%) students in the final HEV sample reported English as their best language, while 7% reported English and another as their best language, 1% reported another language as their best language, and 1% failed to respond. This distribution was very similar to that of the original HEV sample and, relative to the population, slightly overweighted by those reporting English as their best language.

Table 3 shows the mean values for SAT Composite scores, HSGPA, and ARI scores for the Final HEV sample (hereafter referred to as the "HEV sample") and the population. The students in the HEV sample appear to be higher achieving students than those of the general population, with mean SAT scores of 1662, mean HSGPA scores of 3.62, and mean ARI scores of 13.5 compared to 1523, 3.35, and 10.9 respectively. This was expected given that this sample contained only students accepted and enrolled in 4-year institutions.

Table 3

Means and Standard Deviations for the HEV Sample and Population

Predictor/Outcome	HEV		Population	
	Mean	SD	Mean	SD
HSGPA	3.62	.50	3.35	.61
SAT	1662	263	1523	301
ARI	13.5	5.4	10.9	5.5
FYGPA	2.93	.73	N/A	N/A

Note: "Population" is the 2009 College-Bound Seniors cohort restricted to those students who resided within the United States, provided course work information, and self-reported their HSGPA.

Measures

High School Course Work Questions

High School course work questions are asked in five academic areas on the SAT Questionnaire: English, mathematics, science, social sciences/history, and foreign and classical languages. The course work information obtained included the course title and grade level when taken, as well as any dual enrollment, honors, and Advanced Placement Program® (AP) participation. Appendix A contains the form on which students provide coursework completion data.

First-Year GPA (FYGPA)

FYGPA is the GPA that a student earned during his or her first year of college. FYGPA data were provided by each of the 110 universities in the fall after the 2007-08 academic year. All but two of the institutions reported FYGPA on a 0.0–4.0 scale. The two institutions that did not report on a 0.0–4.0 scale had a total of 1,277 students, or 1.9% of the sample, and the highest reported FYGPA was 4.19.

Procedure

The relationship between high school course work participation and first-year GPA (FYGPA) was investigated for each of the five subject areas. The FYGPAs of those who participated in a particular course was compared to the FYGPAs of those who did not take that course and to the overall sample mean. If participants in a particular course (e.g., calculus) or course type (e.g., dual enrollment, honors, or AP) obtained a FYGPA of .05 higher than that of the sample mean or nonparticipants, then participation in that course was considered meaningful, provided that neither participants nor nonparticipants comprised more than 95% of the sample. Students who had participated in such a course would then be awarded 1 or more points.

While the ARI is predominantly based on the empirical evidence between course taking behavior and FYGPA, course-taking patterns that aligned with the College Board definition of a core curriculum (four years of English, three years of math, three years of natural science, and three years of social science or history) were awarded 1 point for each requirement fulfilled. Although there is not a universally accepted definition of a core curriculum, the requirements defined above closely approximate the definition of an essential curriculum first identified by the National Commission on Excellence in Education (1983).

English Subscale

As mentioned above, students who completed the recommended core curriculum in English (four years of courses) were awarded 1 point on the English subscale. The additional 4 points were determined by evaluating the course-taking patterns of the students and how they were associated with performance in college.

Table 4

Percentage of Students and Mean FYGPA by English Course Participation

	Not Enrolled in Course		Enrolled in Course	
	Percent	FYGPA	Percent	FYGPA
Communication	89.9	2.95	10.1	2.73
Creative Writing	84.3	2.94	15.7	2.89
English Language Arts	14.4	2.89	85.6	2.94
English Composition	70.0	2.93	30.0	2.94
English as a Second Language (ESL)	98.8	2.93	1.2	2.85
Journalism	88.6	2.93	11.4	2.94
Literature American	45.7	2.87	54.3	2.98
Literature British	65.9	2.90	34.1	2.99
Literature World	69.6	2.91	30.4	2.98
Public Speaking	79.8	2.94	20.2	2.88

As a first step, the relationship between course work and FYGPA was investigated. Table 4 compares the FYGPAs for students aggregated by their participation (or nonparticipation) in each of the 10 English courses. As Table 4 shows, seven of the 10 courses do not positively distinguish FYGPAs. A course is said to positively distinguish FYGPA if those taking the course have a FYGPA of .05 higher than those not taking the course and/or .05 higher than the overall FYGPA mean of 2.93 while accounting for between 5% and 95% of the sample. Those that do positively distinguish FYGPA are the literature courses (American, British, or world), because students who have taken these courses have mean FYGPAs of 2.98, 2.99, and 2.98, respectively. While these courses did differentiate first-year performance, these courses were not included in the final algorithm because of concerns that students may not have properly identified courses as "literature" when completing the SAT Questionnaire.

Table 5

Percentage of Students and Mean FYGPA by the Number of English Honors and Dual Enrollment (HDE) Courses (N = 67,644)

Number of Courses	% of Students	Mean FYGPA
None	56.3	2.82
One	24.8	3.05
Two	9.2	3.10
Three	5.6	3.14
Four	2.8	3.13
Five	0.8	3.10
Six	0.3	2.98
Seven	0.1	3.06
Eight	0.0	3.13
Nine or More	0.0	2.85
Two or More	90.3	3.11

The next step was to investigate the relationship between advanced courses in English — such as honors, dual enrollment and AP classes — and FYGPA. Table 5 shows the frequency distribution for the number of honors and dual enrollment (HDE) courses taken, as well as the mean FYGPA. The mean FYGPA of those students not taking an HDE course is 2.82, while the mean FYGPA for those students who have taken one HDE course is 3.05 and the mean FYGPA for those who have taken two or more HDE courses is 3.11. Thus, it appears that taking one HDE course differentiates FYGPA from having not taken an HDE course (3.05 vs.

2.82), and taking two HDE courses differentiates FYGPA from having taken one such course (3.11 vs. 3.05). Thus, 1 of the 5 points for the index will be awarded for HDE participation in one class and a total of 2 points will be awarded for HDE participation in two or more classes.

Table 6 contains the frequency distribution for AP participation for each of the two AP English exams; (1) English Language and Composition; and (2) English Literature and Composition. Students not taking any AP English exams had an average FYGPA of 2.82, compared to a mean FYGPA of 3.08 for students taking one AP English exam and 3.18 for students taking both AP English exams. It appears that AP English exam participation differentiates first-year performance. Therefore up to 2 points were awarded for AP courses: 1 point for each class taken.

Table 6

Percentage of Students and Mean FYGPA by the Number of English AP Courses (N = 67,644)

Number of AP English Courses Taken	% of Students	Mean FYGPA
None	60.8	2.82
One	30.6	3.08
Two	8.7	3.18

Math Subscale

Math curriculum in high school generally follows a progression from easier courses (e.g., prealgebra or algebra) in earlier grades to more demanding courses (e.g., statistics or calculus) in later grades. Thus, the relationship between course work and FYGPA was investigated for each grade level (9–12) of high school. One point was assigned per grade completing a math course associated with a higher FYGPA.

Table 7A displays the relationship between ninth-grade course participation and FYGPA. As the table shows, those students participating in integrated math, statistics, algebra II, geometry, trigonometry, precalculus, and calculus had a mean FYGPA of at least .05 higher than that of nonparticipants, and students who participated in these courses were awarded 1 point. Table 7B shows a similar table for 10th-grade students. For 10th-grade students, participation in integrated math, algebra II, statistics, trigonometry, precalculus, and calculus was associated with higher FYGPAs, and participants were awarded 1 point. In 11th grade, participation in statistics, trigonometry, precalculus, and calculus were positively associated with college performance, and 1 point was awarded for participation in these classes (Table 7C). Twelfth-grade completion of statistics and calculus was associated with higher FYGPAs (Table 7D), and 1 point was awarded to those who indicated having taken those classes.

The points awarded for math classes in grades 9–12 are summed to account for 4 of the 5 points awarded on the math subscale. The fifth point is awarded for having taken three years of math courses (in grades 9–12) in accordance with the College Board's core curriculum. In addition, students who had taken AP Calculus were automatically awarded 5 points regardless of other math course-taking behavior. This decision was made to recognize the achievement of those students who may have completed the most difficult math sequence prior to 12th grade. Approximately 28% of the students in the sample took AP Calculus at some time during their career, and these students had an FYGPA of 3.19. No additional points were awarded for HDE courses or AP Statistics because the key factors that differentiated performance in math were the course title and year taken. Completing a more fundamental

math course as a junior or senior, even as an honors course, is often associated with decreased first-year grades in college. For example, students who take algebra II in 11th grade as an honors course have a lower FYGPA (2.92) than those students not taking algebra II in 11th grade (3.03). Additional data on algebra II honors participation is available in Appendix D1. While some other AP, honors, or dual enrollment courses are associated with above average FYGPAs, the association is generally captured by other components of the math subscale.

For example, students participating in AP Statistics are higher-achieving students but are not given additional points for having taken an AP course. A great majority of AP Statistics takers obtained the highest math subscale score of 5, suggesting the rigor of these students' math course work was captured by the other indicators (see Appendix D2).

Table 7A

Percentage of Students and Mean FYGPA by 9th-Grade Math Participation

	Not Enrolled in Course		Enrolled in Course	
	% of Students	Mean FYGPA	% of Students	Mean FYGPA
Prealgebra	94.6	2.95	5.4	2.65
Algebra I	57.0	3.05	43.0	2.77
Other Math	99.4	2.93	0.6	2.82
Integrated Math	96.9	2.93	3.1	3.00
Geometry	56.7	2.83	43.3	3.06
Algebra II	86.8	2.90	13.2	3.13
Statistics	99.7	2.93	0.3	3.02
Trigonometry	97.6	2.93	2.4	3.19
Precalculus	99.6	2.93	0.4	3.20
Calculus	99.9	2.93	0.1	3.14

Table 7B

Percentage of Students and Mean FYGPA by 10th-Grade Math Participation

	Not Enrolled in Course		Enrolled in Course	
	% of Students	Mean FYGPA	% of Students	Mean FYGPA
Prealgebra	98.7	2.93	1.3	2.69
Algebra I	95.1	2.95	4.9	2.66
Other Math	99.0	2.93	1.0	2.87
Integrated Math	96.1	2.93	3.9	3.02
Geometry	56.5	3.03	43.5	2.80
Algebra II	53.5	2.84	46.5	3.03
Statistics	98.9	2.93	1.1	3.14
Trigonometry	88.8	2.90	11.2	3.16
Pre Calculus	93.7	2.91	6.3	3.23
Calculus	99.6	2.93	0.4	3.25

Table 7C

Percentage of Students and Mean FYGPA by 11th-Grade Math Participation

	Not Enrolled in Course		Enrolled in Course	
	% of Students	Mean FYGPA	% of Students	Mean FYGPA
Prealgebra	98.9	2.93	1.1	2.71
Algebra I	98.9	2.93	1.1	2.65
Other Math	97.3	2.93	2.7	2.91
Integrated Math	96.2	2.93	3.8	2.90
Geometry	94.6	2.95	5.4	2.65
Algebra II	66.7	3.03	33.3	2.73
Statistics	95.9	2.92	4.1	3.09
Trigonometry	77.1	2.89	22.9	3.06
Precalculus	56.1	2.82	43.9	3.07
Calculus	92.8	2.91	7.2	3.24

Table 7D

Percentage of Students and Mean FYGPA by 12th-Grade Math Participation

	Not Enrolled in Course		Enrolled in Course	
	% of Students	Mean FYGPA	% of Students	Mean FYGPA
Prealgebra	99.1	2.93	0.9	2.67
Algebra I	99.6	2.93	0.4	2.68
Other Math	92.8	2.94	7.2	2.85
Integrated Math	97.8	2.94	2.2	2.76
Geometry	99.2	2.93	0.8	2.52
Algebra II	96.4	2.95	3.6	2.51
Statistics	84.9	2.91	15.1	3.04
Trigonometry	92.0	2.94	8.0	2.81
Precalculus	79.4	2.97	20.6	2.80
Calculus	62.1	2.81	37.9	3.13

Science Subscale

As with the other subscales, following the College Board definition of a core curriculum, 1 point was awarded to all students who completed three years of science, regardless of which classes were taken. In order to determine how to award the remaining 4 points, the relationship between science course work and FYGPA was investigated. Table 8 displays the results of this analysis. Students completing other science and earth science courses have FYGPAs of 2.88 and 2.89 respectively, less than that of students not participating in these courses. More than 95% of our sample completed a biology course, and over 95% completed a chemistry course. These students had FYGPAs about equal to the overall sample and higher than those few students not taking these courses (2.87 and 2.69, respectively). Approximately two-thirds of our sample took a physics course, and these students had an average FYGPA of 2.98.

Because other academic rigor algorithms (Bridgeman, 2004; Milewski & Sawtell, 2006) have awarded 1 point for completion of three years of science classes — including one each in biology, chemistry, and physics — the relationship between completion of these three courses and FYGPA was investigated. Students completing all three courses had an FYGPA of 2.99, compared to the sample mean of 2.93. Thus, 1 point was awarded to those students who participated in biology, chemistry, and physics.

The number of years of science participation was also investigated. In addition, Table 8 compares the FYGPA of those students having taken four years of science to those having taken fewer than four years of science. Those who had taken four years of science represent 56% of the sample, and these students had a mean FYGPA of 2.99, compared to 2.93 for the sample and 2.85 for those students who had taken fewer than four years of science. Thus, students were awarded 1 point for having taken four years of science because such students had a mean FYGPA that was.05 points higher than that of the sample.

Table 8

Percentage of Students and Mean FYGPA by Science Course Participation

	Not Enrolled in Course		Enrolled in Course	
	% of Students	Mean FYGPA	% of Students	Mean FYGPA
Other Science	61.4	2.96	38.6	2.88
Earth Science	61.9	2.95	38.1	2.89
Biology	2.2	2.87	97.8	2.93
Chemistry	4.6	2.69	95.4	2.94
Physics	34.1	2.83	65.9	2.98
Biology, Chemistry, and Physics	36.5	2.83	63.5	2.99
3 Years of Any Science	5.5	2.76	94.5	2.94
4 Years of Any Science	44.0	2.85	56.0	2.99

Table 9 displays the mean FYGPA and distribution for students disaggregated by the combined number of HDE courses. Students who had not taken an HDE course had a mean FYGPA of 2.81, compared to 3.01 for students who had taken one such course and 2.93 for the sample overall. Thus, participants were awarded 1 point for having taken an HDE course. Table 10 shows the same information for students participating in an AP course. Students with no AP participation had a mean FYGPA of 2.85, compared to 3.10 for those participating in a single AP course and 2.93 for the overall sample. Because 3.10 was more than .05 points higher than the sample mean and more than .05 points higher than 3.01 — the mean for students having taken a single HDE course — two points were awarded for AP participation. Two points were awarded if a student took both honors and AP courses.

Table 9

Percentage of Students and Mean FYGPA by Science Honors and Dual Enrollment (HDE) Participation

Number of HDE Classes Taken	% of Students	Mean FYGPA
0	58.0	2.81
1	12.4	3.01
2	10.8	3.11
3	13.3	3.14
4	4.9	3.15
5	0.6	3.11
6	0.1	3.25
7	0.0	3.21
8	0.0	3.24

Table 10

Percentage of Students and Mean FYGPA by Science Honors/ AP Participation

Number of AP Classes Taken	% of Students	Mean FYGPA
0	67.8	2.85
1	22.5	3.10
2	7.1	3.18
3	2.4	3.05
4	0.2	3.04

Social Science Subscale

Table 11 displays the mean FYGPA and participation rate for the sample by social science course. Participation in two courses — "other social science" and European history — was associated with FYGPAs of at least .05 points higher than the sample mean of 2.93 (2.98 and 3.05, respectively). However, since "other social science" is a composite label for an unidentified number of courses, no points were awarded for "other social science" participation. Regarding European history, one would expect that if history content is associated with a higher FYGPA, then all history courses would have the same association. However, participation in U.S. history and world history courses (for which AP Exams are also offered) were not associated with higher FYGPAs. Only 24.2% of the sample participated in European history, while 96.1% and 84.7% participated in U.S. history and world history, respectively, suggesting that a self-selection effect might have occurred. Furthermore, an ethnicity effect might exist, as white students accounted for 70.6% of European history takers, but only 63.8% of U.S. history takers and 63.3% of world history takers. Thus, no points were awarded for participation in a non-HDE and non-AP European history course.

Table 11

Percentage of Students and Mean FYGPA by Social Science/History Participation

	Not Enrolled in Course		Enrolled in Course	
	% of Students	Mean FYGPA	% of Students	Mean FYGPA
Ancient History	88.3	2.93	11.7	2.97
Economics	43.3	2.97	56.7	2.90
European History	75.8	2.89	24.2	3.05
Geography	64.5	3.00	35.5	2.81
Other Social Science	83.2	2.92	16.8	2.98
Psychology	68.3	2.92	31.7	2.97
Sociology	86.7	2.94	13.3	2.88
U.S. Government	25.2	2.96	74.8	2.92
U.S. History	3.9	2.84	96.1	2.93
World History	15.3	2.93	84.7	2.93
At Least 3 Years of Social Science	6.4	2.85	93.6	2.94
4 Years of Social Science	40.3	2.91	59.7	2.94

Additionally, Table 11 shows the participation percentage and mean FYGPA for students who had taken at least three years of social science/history and four years of social science/history. The mean FYGPA for both groups of students was 2.94, almost identical to the sample mean of 2.93, and a participant/nonparticipant comparison was not undertaken. Based on empirical data alone, points would not be awarded for having had either three or four years of social

science/history. However, 1 point was awarded for three years of study in accordance with the core curriculum.

The bulk of the remaining 4 points on the social science subscale were awarded for participation in HDE and AP courses. Table 12 shows the mean and distribution of FYGPA by the number of HDE and AP courses completed. Students without an HDE or AP course had a FYGPA of 2.74, compared to the sample mean of 2.93. At the other end of the spectrum, students with at least three HDE and AP courses with at least one of each tended to have the highest FYGPAs, ranging from 3.12 to 3.16. Table 13 consolidates Table 12 into five levels and awards up to 4 points for HDE and AP classes. The results of Table 13 are combined with any points awarded for three years of course work to create the social science/history subscale.

Table 12

Percentage of Students and Mean FYGPA by Social Science HDE/AP Participation

Number of AP Classes	Number of HDEs	% of Students	Mean FYGPA
0	0	41.1	2.74
0	1	4.3	2.90
0	2 or more	9.4	2.99
1	0	9.3	3.02
1	1	3.6	3.09
1	2 or more	6.5	3.12
2 or more	0	11.3	3.07
2 or more	1	6.0	3.16
2 or more	2 or more	8.6	3.13

Table 13

Percentage of Students and Mean FYGPA by Social Science HDE and AP Participation

Number of Courses Taken	% of Students	Mean FYGPA	Points Awarded
No HDE or AP	41.1	2.74	0
1 HDE and no AP	4.3	2.90	1
(2 or more HDE and no AP) or (No HDE and 1 AP)	18.7	3.01	2
1 HDE and 1 AP or no HDE and 2 AP	14.9	3.08	3
3 or more combined HDE and AP with at least 1 of each	21.0	3.14	4

Note: The social science/history subscale awards 4 points for honors, dual enrollment, and AP participation and one point for having taken three or more total years of course work.

Foreign/Classical Language Subscale

Table 14 displays the mean and distribution of FYGPA by the number of years of foreign or classical language taken. In this subscale, years of study for all languages were combined and no attempt was made to determine whether taking any one particular language was more strongly associated with FYGPA than any other. Students with fewer than two years of language had a mean FYGPA of 2.72, compared to 2.95 for those with two or more years of

language, 3.02 for those with three or more years of language, and 3.13 for those with four years of language. Given the findings above, up to 3 points were awarded for language course work. One point was awarded for having two years of language, 2 points were awarded for having three years of language, and 3 points were awarded for having four years of language.

Table 14

Percentage of Students and Mean FYGPA by Number of Years of Foreign Classical Language

Number of Years	% of Students	Mean FYGPA	Points Awarded
Fewer than 2	7.4	2.72	0
2 or more	92.6	2.95	1
3 or more	63.6	3.02	2
4 or more	27.9	3.13	3

Tables 15–17 show the sample distribution and mean FYGPA by HDE, AP, and HDE/AP combined. Table 15 indicates that students who have taken an HDE language class in high school had a higher FYGPA (3.13) than those who have not (2.86). Table 16 indicates similar results for AP, as students who took an AP language class had a mean FYGPA of 3.14, compared to that of 2.89 for those who did not take a language AP class. Table 17 combines participation in HDE and AP language courses and reports that students without any HDE or AP language courses had a mean FYGPA of 2.84, while those with one HDE or AP language course had a mean FYGPA of 3.08 and those with two HDE or AP language courses had a mean FYGPA of 3.21. Thus, one point was awarded for having one HDE or AP language course and 2 points were awarded for having two HDE and AP language courses. On the 5-point subscale for foreign/classical language, students were awarded 3 points for course work and 2 points for HDE and AP classes. The complete description for the composition of each of the five subscales is contained in Appendix B.

Table 15

Percentage of Students and Mean FYGPA by HDE Language Participation

Number of HDE Classes	% of Students	Mean FYGPA
0	73.3	2.86
1	25.0	3.13
2	1.6	3.16
3	0.1	3.28
4	0.0	2.99
5	0.0	3.55

Table 16

Percentage of Students and Mean FYGPA by AP Language Participation

Number of AP Classes	% of Students	Mean FYGPA
0	85.0	2.89
1	14.8	3.14
2	0.2	3.18
3	0.0	3.34

Table 17

Percentage of Students and Mean FYGPA by HDE and AP Language Participation

Number of HDE/AP Classes	% of Students	Mean FYGPA	Points Awarded
0	66.3	2.84	0
1	24.6	3.08	1
2	8.3	3.21	2
3 or more	0.8	3.11	2

Phase Two: ARI and College Outcomes

The development of the ARI was the first phase of the research, with the second phase investigating how various measures of college success — including college enrollment, FYGPA, and retention — were associated with the index.

Method

Data

Three different samples were used in the second phase of this research. The first sample was the HEV sample, described in the first phase of the study. The second sample obtained through merging the 2007 SAT College-Bound Seniors cohort and data obtained from the National Student Clearinghouse (NSC). NSC tracks student enrollment and degree attainment for more than 3,100 two- and four-year colleges and universities in the United States (a list of participating institutions is located at www.studentclearinghouse.org), equivalent to 91% of the U.S. college-going population. The College Board's 2007 cohort of graduating high school seniors was merged with data from NSC, which provided enrollment data for the entering freshman class of 2007. The 1,483,661 students from the high school graduating class of 2007 were restricted to those students who provided course work data (from the new SAT Questionnaire), provided high school GPA (HSGPA) information, and resided in the United States. International students were excluded because of the possibility that their answers to the course work questions could confound interpretation of the results. The high school data from these students were then matched to NSC data that provided postsecondary enrollment records. The final sample contained 573,094 students and included both students with postsecondary enrollment records and students who were not enrolled in college.

The third data source — termed the population— was from the 2009 SAT College-Bound Seniors population. This sample consisted of students who have taken the SAT and were expected to graduate from high school in 2009. This sample was restricted to those students who provided HSGPA information and answered the course work questions used to construct the ARI. A further restriction required students to have reported residing in one of the 50 states or the District of Columbia. As a result, number of students was ultimately reduced from 1,530,128 to 1,116,628.

Measures

Academic Rigor Index (ARI)

The derivation for each subscale in the subjects of English, math, science, social science/history, and foreign/classical languages are detailed in phase one of this report. Each of the scores from these five subscales are summed, yielding a total score on a scale of 0–25. For a complete description of the algorithm used to complete each subscale, see Appendix B.

SAT Scores

SAT scores were obtained for all three samples. The SAT consists of three sections: critical reading (SAT-CR), mathematics (SAT-M), and writing (SAT-W), each measured on a 200- to 800-point scale. Composite scores are the sum of all three section scores and range from 600 to 2400. Further information on the SAT can be found on the College Board website: http://professionals.collegeboard.com/testing/sat-reasoning/about.

HSGPA

Cumulative high school GPA data are self-reported by students registering to take the SAT. Scores are reported in letter grades ranging from an F (below 65) to an A+ (97-100).[2] High school grades were then converted to a number on a scale of 0.0–4.33 scale.[3]

Percentage Enrolled in College

The NSC data set provides data on the enrollment on the 573,094 College Board students in the 2007 cohort. Given that college attendance is the first step toward college graduation, enrollment is an important milestone. Therefore, the percentage of students enrolled in college is also used as a criterion variable. As a further refinement, the percentage of students enrolled in all two-year and four-year colleges, only two-year colleges, and only four-year colleges will all be used as criterion variables.

First-Year GPA

Institutions included in the 2007 HEV data set provided both individual course grades and cumulative GPAs for freshman students, with FYGPA chosen as one of the criterion variables to validate ARI. FYGPA had a number of advantages as a criterion. First, the curriculum is more uniform for students in the first year than in later years, thus FYGPA is based upon a more similar criterion than are grades in subsequent years of college. A second reason is that FYGPA is a broad measure of performance in college, incorporating the entirety of students' first-year academic performance, making it more appropriate and representative than individual course grades. Lastly, FYGPA is strongly correlated with eventual graduation from college (Allen, 1999; Murtaugh, Burns, & Schuster, 1999). First-year GPAs ranged from 0 to 4.19. Only two of the institutions, comprising 1,277 students, or 1.9% of the sample, reported any students with GPAs above 4.0.

Percentage Obtaining a FYGPA of B- or Higher

Prior research by Wyatt, Kobrin, Wiley, Camara, and Proestler (2011) suggested that an FYGPA equivalent to a B- was an appropriate criterion by which to measure college readiness. This was based primarily upon feedback from an expert panel of educators and policymakers indicating that a FYGPA criterion of 2.67 (B- at most colleges) was predictive of future college success. Therefore, the percentage of students obtaining a B- or higher in first-year course grades was evaluated as an outcome variable.

Retention to Second Year

Institutions contributing to the 2007 HEV sample indicated whether students returned to college for their sophomore year. Retention to second year will also be used as a criterion variable to measure the validity of the ARI. Although a student may leave college for many reasons, returning to college indicates that the student has met at least the basic academic requirements of the institution.

Analysis

Descriptive statistics were utilized to analyze the distribution of the ARI within the three samples and the relationship between scores on the ARI and outcome variables. These variables included measures of high school performance (HSGPA and SAT scores) and college performance such as college enrollment, the percent obtaining a FYGPA of a B- or higher, and the percent retained to 2nd year. Primary analyses were conducted using the total ARI scale (0-25) but supplemental analyses were also conducted for each of the (0-5 point) sub scales in English, math, science, social science/history, and foreign/classical languages.

Results

Demographic Characteristics

Table C1 (Appendix C) compares the demographic characteristics of the HEV sample, NSC sample, and the population. The HEV sample was used in phase 1 and its demographic characteristics were described in the summary of Part 1 of this report. The NSC sample is very similar to the population in terms of gender, ethnicity, and best language. The NSC sample is slightly overweighted for females and underweighted for males.

Table 18 has the mean values for HSGPA, SAT scores, ARI scores, and FYGPA (where applicable) for the HEV sample, NSC sample, and the population. The NSC sample was very similar to the population in terms of high school achievement, although slightly lower on all three measures. The HEV sample contained the highest-achieving students. However, this was expected because the HEV sample is the only one of the three samples that has been restricted to students who enrolled and attended a four-year university.

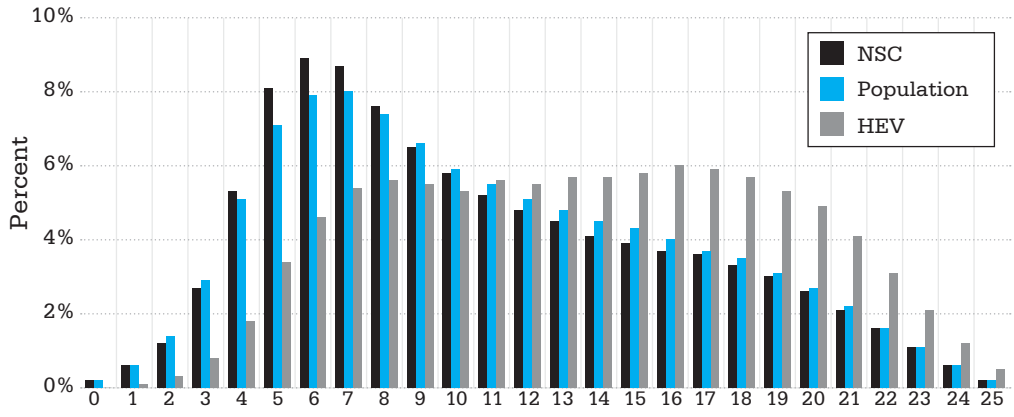
Table 18

Means and Standard Deviations for the HEV Sample, NSC Sample, and Population[4]

	HEV		NSC		Population	
	Mean	SD	Mean	SD	Mean	SD
HSGPA	3.62	.50	3.32	.64	3.35	.62
SAT	1662	263	1495	301	1523	301
ARI	13.5	5.4	10.7	5.4	10.9	5.5
FYGPA	2.93	.73	N/A	N/A	N/A	N/A

Figure 1 shows the frequency distribution of ARI scores for each of the three samples. The population and NSC sample appear very similar because both exhibit positive skew. The HEV sample appears to have more of a flat distribution, with more students obtaining higher ARI scores. This is to be expected given that the HEV sample contains only students enrolled in four-year colleges and universities, whereas the NSC sample and the population contain students not necessarily enrolled in college. These data are also provided in Table C2.

Figure 1
Frequency distribution of the Academic Rigor Index within the HEV data set, NSC data set, and the population



ARI and Other Measures of High School Performance

Table 19 displays information on the concurrent measures of academic performance in high school by the ARI score from the population. These measures include cumulative HSGPA, SAT critical reading (SAT-CR), SAT mathematics (SAT-M), SAT writing (SAT-W), and SAT composite scores. The table indicates that performance on each of these measures rises as the ARI score rises. The differences in concurrent outcomes throughout the range of the ARI scale are substantial. A student with an ARI score of 0 has average HSGPA, SAT-CR, SAT-M, SAT-W, and SAT composite scores of 2.84, 390, 392, 380, and 1162, respectively. A student achieving the maximum ARI score of 25 has mean scores of 3.99, 674, 689, 672, and 2034, respectively, for the same measures. The correlation between the ARI scale of 0–25 and the SAT composite score is 0.68, and the correlation between the ARI scale and HSGPA is 0.51.

Table 19

Mean HSGPA and SAT Scores by ARI Score

Scale Points	Number	Percentage	HSGPA	SAT-CR	SAT-M	SAT-W	SAT Composite
0	2,708	0.2%	2.84	390	392	380	1162
1	6,866	0.6%	2.87	394	395	386	1174
2	16,032	1.4%	2.89	406	407	396	1208
3	32,731	2.9%	2.92	416	417	406	1239
4	56,765	5.1%	2.94	424	424	414	1262
5	79,365	7.1%	2.98	436	436	424	1296
6	87,743	7.9%	3.03	447	449	436	1332
7	89,757	8.0%	3.10	460	465	450	1375
8	82,164	7.4%	3.18	474	482	465	1421
9	73,410	6.6%	3.26	488	497	478	1463
10	65,804	5.9%	3.34	501	512	491	1504
11	61,213	5.5%	3.41	513	526	503	1542
12	57,497	5.1%	3.47	524	538	516	1578
13	53,807	4.8%	3.52	536	550	527	1612
14	49,816	4.5%	3.57	546	560	537	1643
15	47,521	4.3%	3.61	556	570	547	1672
16	44,764	4.0%	3.66	567	582	559	1708
17	41,623	3.7%	3.69	577	592	569	1738
18	38,554	3.5%	3.74	588	605	581	1774
19	34,216	3.1%	3.78	599	615	593	1807
20	29,695	2.7%	3.82	609	627	603	1839
21	24,210	2.2%	3.85	622	638	617	1878
22	17,816	1.6%	3.90	635	651	633	1919
23	12,437	1.1%	3.93	648	662	646	1956
24	7,078	0.6%	3.96	660	674	661	1995
25	3,036	0.3%	3.99	674	689	672	2034

Tables C3A–C3E compare these concurrent measures of high school performance to each of the ARI subscales: English, mathematics, science, social science/history, and language. The results indicate gains in HSGPA and SAT scores for each successive increment on each of the five subscales, as was the case for the total (Academic Rigor Index (ARI) scale. This occurs between any two points on each of the five subscales for all of the measures of high school achievement (HSGPA, SAT-CR, SAT-M, SAT-W, SAT composite). Thus, the ARI subscales themselves also seem to be related to other measures of high school performance. It is worth noting that a particular academic subscore in one subject does not necessarily imply the same level of high school performance as the same score in another subject area. For example, an ARI score of 2 in English is associated with average HSGPA, SAT-CR, SAT-M, SAT-W, and SAT composite scores of 3.51, 533, 541, 525, and 1600, respectively. The same ARI score of 2 in mathematics is associated with lower levels of performance: 3.19, 478, 475, 468, and 1420 for the same measures respectively.

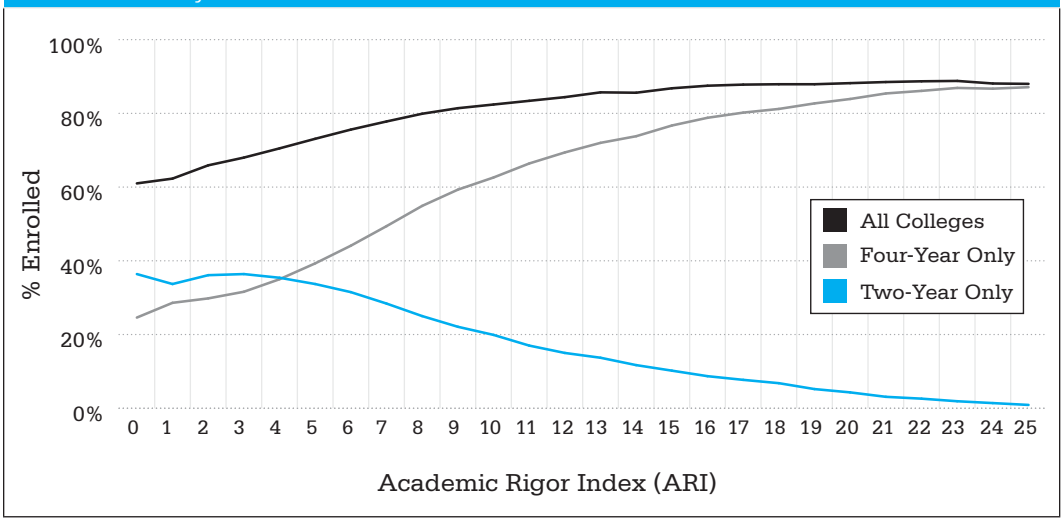
Relationship Between ARI and College Enrollment

Using the NSC sample, the relationship between college-going rates and the ARI scores was investigated. College going rates were examined for all two-year and four-year colleges, and two-year colleges and four-year colleges separately. As can be seen in Figure 2, the results indicate that the percentage of students enrolled in two-year or four-year) colleges increased between 22 of the 25 intervals on the 0–25 scale. In general, the percentage enrolled in college increased as ARI scores increased, with 61.0% of students with a score of 0 attending college and 88.0% of students with a score of 25 attending college.

As an additional analysis, enrollment was disaggregated by two-year and four-year colleges. An analysis of two-year college enrollment shows that, in general, the percentage enrolled decreased as the ARI increased. This is evident at every ARI point from 3 (36.4% enrolled in two-year schools) to 25 (0.9% enrolled in two-year schools).

In contrast, the percentage of students who attended a four-year college generally increased as the ARI increased. At the lowest score of 0, 24.6% of students attended a four-year college. The percentage of students who attended a four-year college increased for every point between 0 and 23, at which 86.9% of students attended a four-year college. At the maximum score of 25, 87.1% of students attended college. This information is also presented in Table C4.

Figure 2
Percentage of students at two-year, and four-year, and all colleges and universities by scores on the ARI



Similar patterns are evident in each of the subscales as well, which can be observed in Tables C4A–C4E. For each of the subscales, the percentage of students enrolled in two-year or four-year colleges increased as the ARI subscores increased. When the enrollment data were disaggregated by school type, the general trend was for two-year school enrollment to decrease as ARI increased, and for four-year school enrollment to increase as ARI increased. While this trend was evident across each of the five subscales, the percentage of students enrolled in college for any one subscale score did differ by subject area. For example, at an English subscale score of 2, 16.6% of students were enrolled in a two-year college and 67.7% were enrolled in a four-year college. In contrast, 23.4% of students with a math subscore of 2 were enrolled in a two-year college while 55.7% were enrolled in a four-year college. In general, however, there was a positive relationship between the ARI and the ARI subscores, and college enrollment rates. When disaggregated by school type, the percentage enrolled in

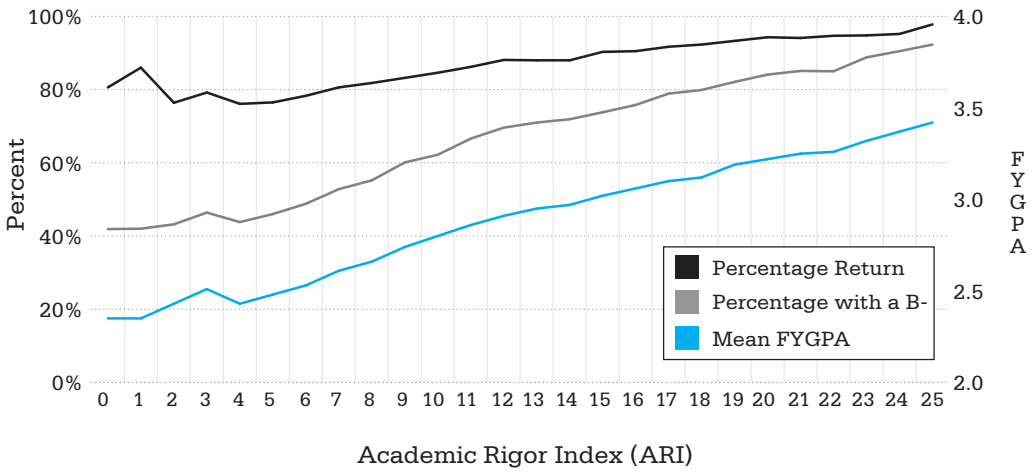
a two-year college actually decreased as the ARI increased, while the percentage of students enrolled in four-year colleges increased.

Relationship Between ARI and College Performance

Figure 3 (or Table C5) displays the percentage of students obtaining a FYGPA equivalent to a B- or higher, the percentage of students who were retained to their second year of college, and the mean FYGPA by ARI score. In general, all measures of performance and retention increased as the ARI increased. Both measures of performance — the percentage obtaining a B- and the mean FYGPA — increased at every ARI point between 4 and 25.

Retention to the second year of college also increased as student ARI scores increased. Students with a score of 4 had a 76.2% retention rate, with retention rates gradually increasing along the scale to end with a retention rate of 97.8% for students with an ARI score of 25. Unlike the other two performance measures, retention did not rise at every point between 4 and 25, although the general trend was toward increased retention with greater scores on the ARI. It should be noted that students not retained did not necessarily drop out; they may have transferred to a school other than the 110 colleges and universities participating in the study.

Figure 3
Percentage of students with an FYGPA equivalent to a B- or higher, percentage of students retained to second year, and mean FYGPA (right scale) by ARI score



Tables C5A–C5E examine the relationship between the ARI subscales and each of the measures of performance and retention. The same trends applied to each of the subscales as to the total scale. However, as noted earlier, the same ARI subscores from different subject areas did not necessarily imply identical academic outcomes. For example, students with a 2 on the English subscale had a mean FYGPA of 2.98, 71.9% had an FYGPA equivalent to a B- or better, and 88.8% were retained to the second year. Students with a 2 on the mathematics subscale have a mean FYGPA of 2.78, 61.9% of them had an FYGPA equivalent to a B- or better and 83.8% were retained.

Discussion

The ARI was designed to quantify the degree of rigor associated with high school course work in English, math, science, social science/history, and foreign/classical language. The index was based predominantly on empirical data, although commonly accepted definitions of core curriculum also influenced the development of the scale. The results of this study indicated that the ARI was positively related to measures of high school achievement and to college enrollment and college performance, and suggests that academic rigor plays an important role in preparing students for college-level work.

Some of the limitations of the ARI should be noted to ensure its appropriate use. First, all of the research presented within this report is based upon samples of students who took the SAT, which are likely to contain a greater percentage of higher-achieving students with college aspirations than the overall population of high school graduates. Thus, findings related to ARI scores from SAT takers should not be generalized to the entire population of high school graduates without further research. Another limitation of the ARI is that the data used to construct it are based on self-reported data and based solely on course title. Thus far, there has not been a systematic comparison between the self-reported course work data on the SAT Questionnaire and actual transcript data to measure the correspondence between the two. Additionally, the reliance on course title could create some difficulty because content and complexity could differ between courses with the same title. As an example, an English honors class at one school may be more difficult than an English honors class at another school. Because the ARI is calculated based on the reported titles of classes, any distinction between courses of similar names would not be captured. Additionally, because the data are self-reported, the potential exists for students to either intentionally or unintentionally misrepresent their high school transcript. Future research might construct the ARI using actual transcript data for a school or county and investigate the relationship of that transcript-based index to college success. Such a study could confirm that students are accurately filling out the SAT Questionnaire and confirm that the predictive validity of the ARI is based on actual course-taking patterns and not attributable to anomalies in the way that students are self-reporting course work.

ARI … allows for a quantitative summary of students' high school course work in a way that can be documented, explained, and analyzed.

Even with these limitations, the ARI could have several practical and valuable uses. One practical usage is that it allows for a quantitative summary of students' high school course work in a way that can be documented, explained, and analyzed. Having a standardized measure of student curriculum could be a valuable tool for use in future research on the relationship between high school predictors and subsequent college outcomes. Another area in which the ARI could be very valuable is aggregate-level reporting to states and districts. Such entities could use the index to track the course work of students over time, both overall

and by specific subject area. Additionally, the course work information in the ARI could be used to identify what courses are associated with college success. For example, an ideal course track in mathematics might include algebra II or geometry in ninth grade, trigonometry in 10th grade, precalculus in 11th grade, and calculus in 12th grade.

Notes

1. "Population" is defined as the 2009 College-Bound Seniors cohort, restricted to those students who resided within the United States, provided course work information, and self-reported their HSGPA.

2. Students are asked to report their cumulative GPA for high school by selecting one of the following options: A+ (97–100), A (93–96), A- (90–92), B+ (87–89), B (83–86), B- (80–82), C+ (77–79), C (73–76), C- (70–72), D+ (67–69), D (65–66), or E or F (Below 65).

3. An A+ is converted to 4.33, A to 4.00, A- to 3.67, B+ to 3.33, B to 3.00, B- to 2.67, C+ to 2.33, C to 2.00, C- to 1.67, D+ to 1.33, D to 1.00, and E or F to 0.00

4. "Population" is defined as the 2009 College-Bound Seniors cohort, restricted to those students who resided within the United States, provided course work information, and self-reported their HSGPA.

5. Ibid.

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Appendix A

SIDE 2 **The SAT Questionnaire allows you to provide information about your academic background, activities, and interests to help you in planning for college and to help colleges find out more about you. The Student Search Service also uses this information.**

21 SAT QUESTIONNAIRE

To answer these questions, please see the SAT Questionnaire in the *SAT Registration Booklet*.

Do not extend your marks into the adjacent ovals.

1. AREA OF STUDY

	None	½	1	2	3	4	More than 4	AP*/ Honors
Mathematics	○	○	○	○	○	○	○	○
English and Language Arts	○	○	○	○	○	○	○	○
Natural Sciences	○	○	○	○	○	○	○	○
Social Sciences and History	○	○	○	○	○	○	○	○
Foreign and Classical Languages	○	○	○	○	○	○	○	○
Arts and Music	○	○	○	○	○	○	○	○

COURSE WORK

	None	Before 9th Grade	9th gr	10th gr	11th gr	12th gr	Honors	AP	Dual Enroll.
2. MATHEMATICS COURSES									
Pre-Algebra or other math course	○	○	○	○	○	○	○		
Algebra I or equivalent	○	○	○	○	○	○	○		
Geometry or equivalent	○	○	○	○	○	○	○		
Algebra II, Advanced Algebra, or equivalent	○	○	○	○	○	○	○		
Integrated Math Program	○	○	○	○	○	○	○		
Trigonometry	○	○	○	○	○	○	○		
Pre-calculus	○	○	○	○	○	○	○		○
Calculus	○	○	○	○	○	○	○	○	○
Statistics	○	○	○	○	○	○	○	○	○
Other mathematics course	○	○	○	○	○	○	○		○
3. ENGLISH/LANGUAGE ARTS COURSES									
English/Language Arts	○	○	○	○	○	○	○	○	○
Journalism	○	○	○	○	○	○	○		○
Creative Writing	○	○	○	○	○	○	○		○
American Literature	○	○	○	○	○	○	○	○	○
Composition/Writing	○	○	○	○	○	○	○		○
British Literature	○	○	○	○	○	○	○	○	○
World Literature	○	○	○	○	○	○	○	○	○
Communications	○	○	○	○	○	○	○		○
Public Speaking	○	○	○	○	○	○	○		○
English as a Second Language	○	○	○	○	○	○	○		○
4. NATURAL SCIENCE COURSES									
Environmental, earth, or space science	○	○	○	○	○	○	○	○	○
Biology	○	○	○	○	○	○	○	○	○
Chemistry	○	○	○	○	○	○	○	○	○
Physics	○	○	○	○	○	○	○	○	○
Other science course	○	○	○	○	○	○	○		○
5. SOCIAL SCIENCE and HISTORY COURSES									
U.S. History	○	○	○	○	○	○	○	○	○
U.S. Government or Civics	○	○	○	○	○	○	○	○	○
European History	○	○	○	○	○	○	○	○	○
World History or Cultures	○	○	○	○	○	○	○	○	○
Ancient History	○	○	○	○	○	○	○		○
Economics	○	○	○	○	○	○	○	○	○
Geography	○	○	○	○	○	○	○	○	○
Psychology	○	○	○	○	○	○	○	○	○
Sociology	○	○	○	○	○	○	○		○
Other social science or history course	○	○	○	○	○	○	○		○
6. FOREIGN and CLASSICAL LANGUAGE COURSES									
Chinese	○	○	○	○	○	○	○	○	○
French	○	○	○	○	○	○	○	○	○
German	○	○	○	○	○	○	○	○	○
Greek	○	○	○	○	○	○	○		○
Hebrew	○	○	○	○	○	○	○		○
Italian	○	○	○	○	○	○	○	○	○
Japanese	○	○	○	○	○	○	○	○	○
Korean	○	○	○	○	○	○	○		○
Latin	○	○	○	○	○	○	○	○	○
Russian	○	○	○	○	○	○	○	○	○
Spanish	○	○	○	○	○	○	○	○	○
Other language course	○	○	○	○	○	○	○		○

7. AVERAGE GRADES

	A	B	C	D	E/F
Mathematics	○	○	○	○	○
English and Language Arts	○	○	○	○	○
Natural Sciences	○	○	○	○	○
Social Sciences and History	○	○	○	○	○
Foreign and Classical Languages	○	○	○	○	○
Arts and Music	○	○	○	○	○

8. GRADE POINT AVERAGE

A+	A	A-	B+	B	B-	C+	C	C-	D+	D	E/F
○	○	○	○	○	○	○	○	○	○	○	○

9. CLASS RANK (a) (b) (c) (d) (e) (f)

10. ART and MUSIC EXPERIENCE (a) (b) (c) (d) (e) (f) (g) (h) (i)

11. COMPUTER EXPERIENCE (a) (b) (c) (d) (e) (f) (g)

12. HIGH SCHOOL and COMMUNITY ACTIVITIES

(Mark up to ten activities.)

	9th	10th	11th	12th	Officer/ Award
Academic honor society	○	○	○	○	○
Art activity or club	○	○	○	○	○
Athletics: Intramural	○	○	○	○	○
Athletics: Varsity	○	○	○	○	○
Career-oriented activity	○	○	○	○	○
Community or service activity	○	○	○	○	○
Computer activity	○	○	○	○	○
Dance activity or club	○	○	○	○	○
Debating or public speaking	○	○	○	○	○
Ethnic or cross-cultural activity	○	○	○	○	○
Foreign exchange or study abroad	○	○	○	○	○
Foreign language activity	○	○	○	○	○
Government or political activity	○	○	○	○	○
Journalism or literary activity	○	○	○	○	○
Junior ROTC	○	○	○	○	○
Music: Instrumental	○	○	○	○	○
Music: Vocal	○	○	○	○	○
Religious activity	○	○	○	○	○
Science or math activity	○	○	○	○	○
School spirit activity	○	○	○	○	○
Theater activity	○	○	○	○	○
Work: Co-op program	○	○	○	○	○
Work: Part-time	○	○	○	○	○
Other activity	○	○	○	○	○

○ I have not participated in any of the above activities.

13. SPORTS (Mark up to six sports.)

(a) (b) (c) (d) (e) (f) (g) (h) (i) (j)
(k) (l) (m) (n) (o) (p) (q) (r) (s) (t)
(u) (v) (w) (x) (y) (z)
(0) (1) (2) (3) (4) (5) (6) (7) (8) (9)

○ I have not participated in any sports.

14-19. PREFERRED COLLEGE CHARACTERISTICS

14. (a) (b) (c) (d)
15. (a) (b) (c) (d)
16. (a) (b) (c) (d) (e) (f) (g)
17. (a) (b) (c) (d) (e) (f)
18. (a) (b) (c) (d) (e) (f)
19. (a) (b) (c)

20. DEGREE GOAL (a) (b) (c) (d) (e) (f) (g)

21-26. CHOICE OF MAJORS

21. First Choice

22. How certain are you about your first choice of major?
○ Very certain
○ Fairly certain
○ Not certain

23.

24.

25.

26.

27. RECEIVE ANNOUNCEMENTS ○ Yes ○ No

28. PSAT/NMSQT® (a) (b) (c) (d)

29. ADVANCED PLACEMENT PROGRAM®/EXEMPTION PLANS (a) (b) (c) (d) (e) (f) (g) (h) (i) (j) (k) (l)

30. HELP REQUESTED (a) (b) (c) (d) (e) (f) (g)

31. COLLEGE PROGRAMS AND ACTIVITIES
(a) (b) (c) (d) (e) (f) (g) (h) (i) (j) (k)
(l) (m) (n) (o) (p) (q) (r) (s) (t) (u)

32. FINANCIAL AID ○ Yes ○ No ○ I don't know

33. PART-TIME JOB ○ Yes ○ No ○ I don't know

34. HOUSING PREFERENCE (a) (b) (c) (d)

35. ETHNICITY (a) (b) (c) (d) (e) (f) (g) (h)

36. a. FIRST LANGUAGE (a) (b) (c)

b. BEST LANGUAGE (a) (b) (c)

37. CITIZENSHIP (a) (b) (c) (d)

38. RELIGIOUS PREFERENCE

39. DISABLING CONDITION (a) (b) (c) (d) (e) (f) (g) (h) (i) (j) (k)

40. SELF-RATINGS

	HIGHEST	ABOVE AVERAGE	AVERAGE	BELOW AVERAGE
Mathematical ability	(1)	(2)	(3)	(4)
Scientific ability	(1)	(2)	(3)	(4)
Writing ability	(1)	(2)	(3)	(4)

41. PARENTS' EDUCATION

Father's (a) (b) (c) (d) (e) (f) (g) (h) (i) (j)

Mother's (a) (b) (c) (d) (e) (f) (g) (h) (i) (j)

42. FAMILY INCOME

(a) (b) (c) (d) (e) (f) (g) (h) (i) (j) (k) (l) (m) (n) (o) (p)

22 STATEMENT and SIGNATURE (REQ'D FIELD)

Copy the statement below (do not print).

I hereby agree to the conditions set forth in the *SAT Registration Booklet* and certify that I am the person whose name and address appear on this Registration Form.

By signing below, you agree not to share any test questions or essay topics with anyone after you test by any form of communication, including, but not limited to: verbal, e-mail, text messages, or use of the Internet.

SIGNATURE (Sign as you would on an official document.)

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Appendix B

English Scale (0 to 5 points)

A student is awarded 1 point for having taken four years (excluding courses taken concurrently) of English in grades 9–12 (0/1)

A student is awarded between 0 and 4 points depending on honors, dual enrollment (HDE)* and AP participation: (0/4)

No HDE, no AP = 0
1 HDE, no AP = 1
2 or more HDEs, no AP = 2
1 HDE, 1 AP = 3
2 or more HDEs, 1 AP = 4
2 AP = 4
* Honors and/or dual enrollment courses are referred to as HDE.

Math Scale (0 to 5 points)

Students are awarded 1 point for having taken three years (excluding courses taken concurrently) of math in grades 9–12 (0/1).

Each class is reviewed and students are assigned a value of 1 if they have taken the class in the grade for which a point is awarded (see chart below). A maximum of 1 point is awarded for each grade.

The points earned for grades 9–12 are summed for a total of between 0 and 4 points and then added to the points awarded for having taken three years of math for a possible subscale range of 0–5.

If students have taken an AP Calculus Exam, they are automatically awarded 5 points.

	9th	10th	11th	12th
None	0	0	0	0
Prealgebra	0	0	0	0
Algebra 1	0	0	0	0
Algebra 2	1	1	0	0
Geometry	1	0	0	0
Trigonometry	1	1	1	0
Precalc	1	1	1	0
Calc	1	1	1	1
Stats	1	1	1	1
Integrated Math	1	1	0	0
Other Math	0	0	0	0

Science (0 to 5 points)

A student is awarded 1 point for having taken biology, chemistry, and physics (0/1)
A student is awarded 1 point for having taken three years of science in grades 9–12 (0/1)
A student is awarded 1 point for having taken four years of science in grades 9–12 (0/1)

Students are awarded up to 2 points depending on their AP participation:

1 point for having taken any HDE science course
2 points for having taken an AP course (0/2)

Social Science (0 to 5 points)

Students are awarded 1 point for three or more years of social science (0/1)
Students are awarded points for honors, dual enrollment, and AP participation (0/4):

0 points if no HDE, or AP
1 point for having 1 HDE class but no AP classes
2 points for having two or more HDEs and no AP or no HDEs and one AP
3 points for having one HDE and one AP or no HDEs and two or more AP classes
4 points for having three combined HDE and AP courses with at least one of each.

Foreign and Classical Language (0 to 5 points)

Course work (3 points)
1 point for having taken two years of language (grades 9–12)
2 points (0/1) for having taken three years of language
3 points for having taken four or more years of language
Honors/AP/Dual Enrollment (2 points)

1 point for each HDE or AP language course taken

Appendix C

Table C1

Demographic Characteristics of the HEV Sample, NSC Sample, and Population[5]

Variable	Class	HEV Sample		NSC Sample		Population	
		Number	Percentage	Number	Percentage	Number	Percentage
Gender	Female	39,189	58%	329,358	58%	620,580	56%
	Male	28,455	42%	243,034	42%	496,048	44%
Race/Ethnicity	American Indian	358	1%	4,164	1%	6,657	1%
	African American	5,796	9%	85,136	15%	140,442	13%
	Asian American	6,809	10%	51,278	9%	98,798	9%
	Hispanic	6,951	10%	81,661	14%	152,968	14%
	White	43,130	64%	326,234	57%	662,683	59%
	Other	1,908	3%	20,717	4%	32,441	3%
	No Response	2,692	4%	3,904	1%	22,639	2%
Best Language	English	61,503	91%	502,590	88%	986,714	88%
	English and Another Language	4,594	7%	50,346	9%	103,776	9%
	Another Language	732	1%	11,303	2%	18,891	2%
	No Response	815	1%	8,855	2%	7,247	1%

Table C2

Frequency Distribution of the ARI within the HEV Sample, NSC Sample, and the Population

Scale Points	HEV Number	Percentage	NSC Number	Percentage	Population Number	Percentage
0	31	0.0%	1,256	0.2%	2,708	0.2%
1	100	0.1%	3,257	0.6%	6,866	0.6%
2	220	0.3%	7,064	1.2%	16,032	1.4%
3	530	0.8%	15,587	2.7%	32,731	2.9%
4	1,232	1.8%	30,596	5.3%	56,765	5.1%
5	2,304	3.4%	46,707	8.1%	79,365	7.1%
6	3,084	4.6%	51,290	8.9%	87,743	7.9%
7	3,676	5.4%	49,897	8.7%	89,757	8.0%
8	3,769	5.6%	43,342	7.6%	82,164	7.4%
9	3,704	5.5%	37,278	6.5%	73,410	6.6%
10	3,599	5.3%	33,070	5.8%	65,804	5.9%
11	3,762	5.6%	30,048	5.2%	61,213	5.5%
12	3,720	5.5%	27,608	4.8%	57,497	5.1%
13	3,878	5.7%	25,552	4.5%	53,807	4.8%
14	3,876	5.7%	23,663	4.1%	49,816	4.5%
15	3,919	5.8%	22,288	3.9%	47,521	4.3%
16	4,036	6.0%	21,468	3.7%	44,764	4.0%
17	3,968	5.9%	20,421	3.6%	41,623	3.7%
18	3,871	5.7%	18,903	3.3%	38,554	3.5%
19	3,607	5.3%	17,083	3.0%	34,216	3.1%
20	3,340	4.9%	14,881	2.6%	29,695	2.7%
21	2,765	4.1%	12,120	2.1%	24,210	2.2%
22	2,094	3.1%	8,969	1.6%	17,816	1.6%
23	1,420	2.1%	6,049	1.1%	12,437	1.1%
24	818	1.2%	3,387	0.6%	7,078	0.6%
25	324	0.5%	1,310	0.2%	3,036	0.2%

Table C3A

Mean HSGPA and SAT Scores by ARI English Subscale Score

Scale Points	Number	Percentage	HSGPA	SAT-CR	SAT-M	SAT-W	SAT Composite
0	270,198	24.2%	3.13	462	474	454	1390
1	390,390	35.0%	3.18	476	491	466	1432
2	160,042	14.3%	3.51	533	541	525	1600
3	124,731	11.2%	3.60	555	558	545	1658
4	92,752	8.3%	3.71	583	584	575	1741
5	78,515	7.0%	3.78	603	599	595	1797

Table C3B

Mean HSGPA and SAT Scores by ARI Math Subscale Score

Scale Points	Number	Percentage	HSGPA	SAT-CR	SAT-M	SAT-W	SAT Composite
0	19,897	1.8%	2.88	418	407	406	1231
1	384,476	34.4%	3.11	462	456	451	1368
2	151,758	13.6%	3.19	478	475	468	1420
3	101,285	9.1%	3.29	495	501	485	1481
4	168,324	15.1%	3.47	531	547	522	1600
5	290,888	26.1%	3.73	580	615	575	1769

Table C3C

Mean HSGPA and SAT Scores by ARI Science Subscale Score

Scale Points	Number	Percentage	HSGPA	SAT-CR	SAT-M	SAT-W	SAT Composite
0	85,609	7.7%	3.05	441	440	433	1314
1	245,810	22.0%	3.11	461	460	451	1372
2	259,280	23.2%	3.25	489	494	480	1463
3	260,150	23.3%	3.41	519	532	511	1562
4	146,345	13.1%	3.64	561	579	553	1692
5	119,434	10.7%	3.77	598	629	591	1819

Table C3D

Mean HSGPA and SAT Scores by ARI Social Science/History Subscale Score

Scale Points	Number	Percentage	HSGPA	SAT-CR	SAT-M	SAT-W	SAT Composite
0	95,448	8.5%	3.09	447	457	440	1344
1	527,279	47.2%	3.16	470	481	461	1412
2	59,751	5.4%	3.46	517	525	508	1550
3	172,693	15.5%	3.53	537	547	529	1613
4	115,413	10.3%	3.64	579	582	568	1729
5	146,044	13.1%	3.71	587	594	577	1758

Table C3E

Mean HSGPA and SAT Scores by ARI Language Subscale Score

Scale Points	Number	Percentage	HSGPA	SAT-CR	SAT-M	SAT-W	SAT Composite
0	124,939	11.2%	3.12	446	456	433	1334
1	367,978	33.0%	3.24	480	489	467	1436
2	306,347	27.4%	3.33	509	519	500	1528
3	187,307	16.8%	3.49	542	551	537	1630
4	85,993	7.7%	3.67	580	587	579	1746
5	44,064	3.9%	3.77	613	621	616	1851

Table C4

Relationship Between ARI and the Percentage Enrolled in College Using the NSC Sample

Scale Points	Number	Percentage of Total	All Colleges	2-Year Only	4-Year Only
0	1,256	0.2%	61.0%	36.4%	24.6%
1	3,257	0.6%	62.3%	33.7%	28.6%
2	7,064	1.2%	65.9%	36.1%	29.8%
3	15,587	2.7%	68.0%	36.4%	31.6%
4	30,596	5.3%	70.5%	35.4%	35.0%
5	46,707	8.1%	73.1%	33.7%	39.3%
6	51,290	8.9%	75.6%	31.5%	44.1%
7	49,897	8.7%	77.8%	28.4%	49.4%
8	43,342	7.6%	79.9%	25.0%	54.9%
9	37,278	6.5%	81.4%	22.1%	59.3%
10	33,070	5.8%	82.4%	19.9%	62.6%
11	30,048	5.2%	83.4%	17.0%	66.4%
12	27,608	4.8%	84.4%	15.0%	69.4%
13	25,552	4.5%	85.7%	13.7%	72.0%
14	23,663	4.1%	85.6%	11.7%	73.8%
15	22,288	3.9%	86.8%	10.2%	76.7%
16	21,468	3.7%	87.5%	8.7%	78.8%
17	20,421	3.6%	87.8%	7.7%	80.2%
18	18,903	3.3%	87.9%	6.8%	81.2%
19	17,083	3.0%	87.9%	5.2%	82.7%
20	14,881	2.6%	88.2%	4.3%	83.9%
21	12,120	2.1%	88.5%	3.1%	85.4%
22	8,969	1.6%	88.7%	2.6%	86.1%
23	6,049	1.1%	88.8%	1.9%	86.9%
24	3,387	0.6%	88.1%	1.4%	86.7%
25	1,310	0.2%	88.0%	0.9%	87.1%

Table C4A

Relationship Between ARI English Subscale Score and the Percentage Enrolled in College

Scale Points	Number	Percentage of Total	All Colleges	2-Year Only	4-Year Only
0	106,904	18.7%	76.1%	26.2%	49.9%
1	235,130	41.0%	78.3%	26.1%	52.2%
2	75,220	13.1%	84.4%	16.6%	67.7%
3	65,394	11.4%	85.2%	12.3%	72.9%
4	49,425	8.6%	86.6%	9.2%	77.5%
5	41,021	7.2%	87.3%	6.7%	80.6%

Table C4B

Relationship Between ARI Math Subscale Score and the Percentage Enrolled in College

Scale Points	Number	Percentage of Total	All Colleges	2-Year Only	4-Year Only
0	11,048	1.9%	67.2%	34.8%	32.4%
1	228,328	39.8%	76.9%	28.5%	48.4%
2	75,524	13.2%	79.1%	23.4%	55.7%
3	46,730	8.2%	81.1%	20.5%	60.6%
4	70,155	12.2%	84.1%	15.2%	68.8%
5	141,309	24.7%	87.3%	7.3%	80.1%

Table C4C

Relationship Between ARI Science Subscale Score and the Percentage Enrolled in College

Scale Points	Number	Percentage of Total	All Colleges	2-Year Only	4-Year Only
0	44,686	7.8%	71.8%	32.3%	39.5%
1	130,004	22.7%	76.7%	28.9%	47.8%
2	136,881	23.9%	79.3%	23.8%	55.5%
3	128,275	22.4%	83.4%	16.8%	66.6%
4	73,059	12.7%	86.5%	10.3%	76.2%
5	60,189	10.5%	87.4%	5.7%	81.6%

Table C4D

Relationship Between ARI Social Science Subscale Score and the Percentage Enrolled in College

Scale Points	Number	Percentage of Total	All Colleges	2-Year Only	4-Year Only
0	39,768	6.9%	73.1%	28.5%	44.6%
1	296,988	51.8%	77.9%	26.0%	51.8%
2	27,163	4.7%	83.9%	18.2%	65.7%
3	83,779	14.6%	85.5%	14.7%	70.9%
4	54,720	9.5%	86.4%	10.1%	76.3%
5	70,676	12.3%	86.4%	8.2%	78.2%

Table C4E

Relationship Between ARI Language Subscale Score and the Percentage Enrolled in College

Scale Points	Number	Percentage of Total	All Colleges	2-Year Only	4-Year Only
0	70,819	12.4%	71.2%	30.1%	41.2%
1	194,316	33.9%	78.7%	26.3%	52.4%
2	149,376	26.1%	82.9%	18.9%	64.0%
3	90,308	15.8%	84.2%	13.0%	71.2%
4	45,615	8.0%	87.3%	7.9%	79.4%
5	22,660	4.0%	87.8%	5.4%	82.5%

Table C5

Relationship Between ARI and FYGPA, the Percentage Obtaining a B- or Higher, and the Percentage Returning for Sophomore Year Using the HEV Sample

Scale Points	Number	Percentage	Mean FYGPA	Percentage with B-	Percentage Return
0	31	0.0%	2.35	41.9%	80.6%
1	100	0.1%	2.35	42.0%	86.0%
2	220	0.3%	2.43	43.2%	76.4%
3	530	0.8%	2.51	46.4%	79.2%
4	1,232	1.8%	2.43	43.8%	76.1%
5	2,304	3.4%	2.48	46.0%	76.5%
6	3,084	4.6%	2.53	48.8%	78.3%
7	3,676	5.4%	2.61	52.8%	80.6%
8	3,769	5.6%	2.66	55.2%	81.8%
9	3,704	5.5%	2.74	60.1%	83.2%
10	3,599	5.3%	2.80	62.2%	84.6%
11	3,762	5.6%	2.86	66.6%	86.2%
12	3,720	5.5%	2.91	69.6%	88.1%
13	3,878	5.7%	2.95	71.0%	88.0%
14	3,876	5.7%	2.97	71.9%	88.0%
15	3,919	5.8%	3.02	73.8%	90.3%
16	4,036	6.0%	3.06	75.8%	90.5%
17	3,968	5.9%	3.10	78.9%	91.7%
18	3,871	5.7%	3.12	79.9%	92.3%
19	3,607	5.3%	3.19	82.1%	93.3%
20	3,340	4.9%	3.22	84.1%	94.3%
21	2,765	4.1%	3.25	85.1%	94.1%
22	2,094	3.1%	3.26	85.0%	94.7%
23	1,420	2.1%	3.32	88.8%	94.8%
24	818	1.2%	3.37	90.5%	95.2%
25	324	0.5%	3.42	92.3%	97.8%

Table C5A

Relationship Between ARI English Subscale Score and FYGPA, the Percentage Obtaining a B- or Higher, and the Percentage Returning for Sophomore Year

Scale Points	Number	Percentage	Mean FYGPA	Percentage with B-	Percentage Return
0	8,451	12.5%	2.74	59.5%	85.2%
1	20,508	30.3%	2.75	60.4%	83.7%
2	10,084	14.9%	2.98	71.9%	88.8%
3	10,994	16.3%	3.01	73.6%	89.7%
4	9,125	13.5%	3.14	79.7%	91.7%
5	8,482	12.5%	3.18	82.0%	92.7%

Table C5B

Relationship Between ARI Math Subscale Score and FYGPA, Percentage Obtaining a B- or Higher, and the Percentage Returning for Sophomore Year

Scale Points	Number	Percentage	Mean FYGPA	Percentage with B-	Percentage Return
0	396	0.6%	2.53	50.3%	77.0%
1	17,836	26.4%	2.66	55.5%	82.1%
2	6,649	9.8%	2.78	61.9%	83.8%
3	4,817	7.1%	2.86	65.7%	85.9%
4	9,685	14.3%	2.94	70.9%	87.8%
5	28,261	41.8%	3.15	80.5%	92.9%

Table C5C

Relationship Between ARI Science Subscale Score and FYGPA, Percentage Obtaining a B- or Higher, and the Percentage Returning for Sophomore Year

Scale Points	Number	Percentage	Mean FYGPA	Percentage with B-	Percentage Return
0	2,249	3.3%	2.63	53.3%	81.1%
1	9,190	13.6%	2.71	58.3%	81.2%
2	13,494	19.9%	2.81	63.7%	84.8%
3	17,125	25.3%	2.93	69.5%	88.2%
4	12,636	18.7%	3.05	75.6%	90.8%
5	12,950	19.1%	3.15	80.1%	93.5%

Table C5D

Relationship Between ARI Social Science Subscale Score and FYGPA, Percentage Obtaining a B- or Higher, and the Percentage Returning for Sophomore Year

Scale Points	Number	Percentage	Mean FYGPA	Percentage with B-	Percentage Return
0	2,594	3.8%	2.72	58.5%	83.8%
1	25,387	37.5%	2.75	60.0%	83.5%
2	3,420	5.1%	2.92	68.4%	87.5%
3	12,464	18.4%	3.01	73.9%	89.6%
4	9,832	14.5%	3.08	76.9%	91.3%
5	13,947	20.6%	3.14	79.7%	92.4%

Table C5E

Relationship Between ARI Language Subscale Score and FYGPA, Percentage Obtaining a B- or Higher, and Percentage Returning for Sophomore Year

Scale Points	Number	Percentage	Mean FYGPA	Percentage with B–	Percentage Return
0	4,432	6.6%	2.68	57.1%	82.2%
1	17,723	26.2%	2.76	60.5%	84.2%
2	18,296	27.0%	2.90	68.0%	87.0%
3	14,138	20.9%	3.02	74.2%	90.4%
4	8,426	12.5%	3.16	81.5%	92.7%
5	4,629	6.8%	3.25	85.4%	93.5%

Appendix D

Table D1

Mean FYGPA by Algebra II Course and Honors Participation: By Grade

	No Algebra II		Algebra II / Not Honors		Algebra II Honors	
	Percentage	FYGPA	Percentage	FYGPA	Percentage	FYGPA
9th	86.8	2.90	7.9	3.07	5.3	3.23
10th	53.5	2.84	29.0	2.96	17.5	3.15
11th	66.7	3.03	28.1	2.70	5.2	2.92
12th	96.4	2.95	3.4	2.48	0.2	2.84

Table D2

Mean FYGPA by Math Subscale Score and Participation in AP Statistics

	No AP Statistics		AP Statistics	
	Percentage	FYGPA	Percentage	FYGPA
0	0.6	2.52	0.0	3.58
1	26.4	2.66	0.0	3.02
2	9.1	2.77	0.7	2.88
3	6.9	2.86	0.3	3.02
4	13.1	2.93	1.2	3.06
5	34.0	3.14	7.8	3.19

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