

Considering Practical Uses of Advanced Placement[®] Information in College Admission

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Executive Summary

This study evaluated the predictive validity of various operationalizations of AP[®] Exam and course information that could be used to make college admission decisions. The incremental validity of the different AP variables, above and beyond traditional admission measures such as SAT[®] scores and high school grade point average (HSGPA), in predicting first-year grade point average (FYGPA) was also explored. The AP variables examined included the following: the number of AP Exams a student took, the number of AP Exams a student took on which he or she received a score of 3 or higher, the proportion of the number of AP Exams the student took in relation to the number of AP courses offered at his or her high school, his or her average AP score, his or her highest AP score, and his or her lowest AP score. Results showed that the two AP predictors most strongly related to FYGPA were the average AP score and the highest AP score, followed by the number of AP scores the student received that were greater than or equal to 3. With regard to the incremental validity of the different AP predictors above and beyond HSGPA and SAT scores to predict FYGPA, we found that the AP Average score variable produced the greatest increment. This report discusses the practical implications of these results in using AP information, in addition to traditional admission measures to improve admission decisions.

Introduction

The Advanced Placement Program® (AP), administered by the College Board since 1955, provides high school students with the opportunity to engage in college-level course work and demonstrate mastery of the material through corresponding end-of-course examinations. There are currently more than 30 AP courses offered in areas ranging from Art History to Physics. Each AP course, modeled on a comparable college course that is developed in collaboration with high school teachers and college/university faculty, has an associated exam. The exam is criterion-referenced, and students earn scores on a scale ranging from 1 to 5. An AP Exam score of 5 is equivalent to a grade of A in the corresponding college course; a score of 4 is equivalent to grades of A-, B+, and B in college; and a score of 3 is equivalent to grades of B-, C+, and C in college. Most four-year colleges and universities in the United States grant college credit and/or course exemption for successful AP Exam scores. However, each institution develops its own placement and credit-granting policies to fit its specific needs (<https://apscore.collegeboard.org/creditandplacement/search-credit-policies>).

While AP was not traditionally considered or used as part of the admission decision process, we know that this has been changing over time. For example, in a study by Breland, Maxey, Gernand, Cumming, and Trapani (2002) that surveyed admission professionals on the average importance of various factors considered in admission decisions over the years 1979, 1985, 1992, and 2000, we learn that AP factors were first added to the list of factors surveyed in 2000. These AP factors included AP Course Enrollment, AP Course Grades, and AP Exam Grades (now called “scores”). Using a scale of *1 = Not considered* to *5 = The single most important factor*, Breland et al. found that among public institutions, AP Course Enrollment and AP Course Grades had a mean importance of 2.2, and AP Exam Grades had a mean of 1.8. For reference, HSGPA had a mean of 4.0, and admission test scores had a mean of 3.7. Among private institutions, the means were slightly higher for the AP factors: AP Course Enrollment and AP Course Grades had a mean value of 2.5 each, and AP Exam Grades had a mean of 2.1.

For students who do participate in AP, there is a great deal of empirical evidence showing the positive relationships between AP courses and exams with many college outcomes — even after controlling for relevant student characteristics, such as demographic information and prior academic performance (Chajewski, Mattern, & Shaw, 2011; Mattern, Shaw, & Xiong, 2009; Scott, Tolson, & Lee, 2010). For example, AP course participation and exam performance have been positively associated with attending a four-year institution (Chajewski et al., 2011), the grade earned in the subsequent college course (Casserly, 1986; Dodd, Fitzpatrick, De Ayala, & Jennings, 2002; Keng & Dodd, 2008; Morgan & Crone, 1993; Morgan & Ramist, 1998), enrollment in a corresponding college major (Mattern, Shaw, & Ewing, 2011; Morgan & Klaric, 2007; Morgan & Maneckshana, 2000; Tai, Liu, Almarode, & Fan, 2010), first-year grade point average (FYGPA) (Hargrove, Godin, & Dodd, 2008; Mattern et al., 2009; Scott et al., 2010), retention to the second year (Mattern et al., 2009), and graduation (Dougherty, Mellor, & Jian, 2006; Mattern, Marini, & Shaw, 2013).

Despite the research on AP participation and performance with related college outcomes, there is currently no single best practice for using AP information in college admission decisions. Usually AP seems to be considered as evidence of the rigor of the student’s course work pursued in high school and factored into a weighted grade point average or as contextual information on the general rigor of the student’s high school based on the number of AP courses offered (Wehde-Roddiger, Trevino, Anderson, Arrambide, O’Conor, & Onwuegbuzie, 2012). A sizeable amount of research shows that taking AP courses in high school can positively influence admission decisions, whereby AP courses on a student’s high

school transcript result in improved chances for college admission (Santoli, 2002). Currently, colleges and universities tend to focus on taking the AP course and the course grade rather than the AP Exam score. Often college admission staff add extra weight or bonus points to AP course grades when calculating high school grade point average (HSGPA) (Attewell, 2001; Hebel, 1999; Rigol, 2003; Wehde-Roddiger et al., 2012), which tends to increase the validity of the HSGPA in predicting first-year college GPA (Sadler, 2010). At some institutions, students can even be penalized for not taking an AP course when it was available to them (Lawrence, 1996). Interestingly, Hacsí (2004) has noted that there does not seem to be any form of penalization by colleges and universities for students receiving low AP Exam scores. He concludes that taking the test can really only serve to benefit the students who do well on it and can receive college credit for the course.

Although we more readily see AP course taking rather than AP Exam scores considered in college admission, research at the University of California has found that a combined measure of the number of AP and Honors courses taken by a student did not significantly predict college outcomes, but AP Exam scores did predict college outcomes (Geiser & Santelices, 2004). Although there have been methodological flaws noted in this study (Camara & Michaelides, 2005), including the failure to account for assumptions in multiple regression, lack of correlational information provided, and the grouping of AP courses with Honors courses, it would be worthwhile to investigate questions similar to those asked by Geiser and Santelices across a national sample.

In addition to incorporating AP admission measures at the student level, it seems that colleges and universities consider AP information at the high school level to contextualize student performance and better understand the quality and rigor of the students' high school curriculum. For example, many high schools prepare fact sheets about their respective schools, which are attached to their students' high school transcripts. The fact sheets include descriptive information for college admission staff, such as the proportion of the high school's seniors who are accepted to four-year colleges, the SAT score distribution of the graduating class, the number of students taking AP courses and the AP grades received in those courses, and the number of National Merit Scholarship finalists, among other factors (Attewell, 2001; Rigol, 2003). The number of AP Exams taken by each high school's students has been used by Jay Mathews in *Newsweek* as a measure of high school quality and high standards in ranking U.S. high schools, though not without criticism for its narrow scope in capturing what makes a high school exemplary (Hasci, 2004). Santoli (2002) found that earlier research on the AP Program showed that the number of AP courses offered at a high school appeared to positively affect the college performance of even those students from the high school who did not take any AP courses.

Extensive research on the positive relationship between AP courses and exams and college outcomes, along with anecdotal information from the college admission community pointing to an AP advantage for students (Attewell, 2001; Espenshade, Hale, & Chung, 2005; Lawrence, 1996; Rigol, 2003; Santoli, 2002), makes it clear that we need additional research to more deeply understand the most appropriate role(s) for AP in college admission. A recent study of the value of AP in four-year college admission employed a model-based approach to evaluate relevant demographic, academic (including AP), and institutional characteristics in predicting student FYGPA (Shaw, Marini, & Mattern, 2013). The primary goal of this study was to understand whether and how particular AP variables, including the number of AP Exams a student took, the number of AP Exams a student took for which he or she received a score of 3 or higher, the proportion of the number AP Exams the student took in relation to the number of AP courses offered at the student's high school, the student's average AP

Exam score, the student's highest AP Exam score, and the student's lowest AP Exam score contributed to the prediction of FYGPA, holding other variables constant. The study found that AP information did indeed improve the prediction of FYGPA above traditional academic admission predictors and other student background variables. The AP predictor that most improved model fit was the average AP Exam score. The final model that included multiple AP variables, and most improved model fit included the average AP score, the number of AP Exams a student took on which he or she received a score of 3 or higher, and the AP Proportion. (The latter variable had a negative relationship with FYGPA.) These findings provide evidence of the value of using AP information in college admission decisions, and in particular highlight the role that the average AP Exam score can play in improving these decisions.

Although the results from Shaw et al. (2013) are valuable to the college admission community, traditional admission validity studies examining the relationship between admission predictors and outcomes such as FYGPA tend to use correlational analyses. This study will employ such methods with a national sample. We will evaluate the validity of various operationalizations of AP Exam and course information for predicting FYGPA that could be useful to college admission professionals. In addition, the incremental validity of the different AP variables, above traditional admission measures such as SAT scores and HSGPA, in predicting FYGPA will be explored.

Method

Sample

The sample in this study is based on first-time, first-year students who entered college in the fall of 2008. The total sample was composed of 250,974 students from 129 four-year colleges and universities across the U.S. To be included in analyses, students had to have SAT scores, a self-reported HSGPA, at least one AP score, and high school information on the number of AP courses offered at their school. The final sample consisted of 100,623 students across 128* colleges and universities. The study sample was 55.5% female. As for race/ethnicity, 67.4% of the sample was white, 12.5% Asian, 9.3% Hispanic, 5.4% African American, 0.4% American Indian, and 5.1% was Other or not stated. The majority of the sample's best language was English only (89.5%), followed by 7.2% reporting English and another language, 1.4% reporting another language, and 1.9% not stating a best language. As for highest level of parental education, 24.5% of the sample reported lower than a bachelor's degree, 33.3% reported a bachelor's degree, and 36.6% reported higher than a bachelor's degree, with 5.6% not responding.

Measures

AP Exam Count. All AP measures in the study were obtained from official College Board records. AP Exam Count is the number of AP Exams that a student completed, not the number of AP courses completed. For the sample, AP Exam Count ranged from 1 to 19, with a mean of 3.51 and a standard deviation of 2.38.

AP High School Count (AP HS Count). This is the number of AP courses offered at a student's high school from a database maintained by the Advanced Placement Program at the College Board. For this sample, AP HS Count ranged from 1 to 34, with a mean of 15.14 and a standard deviation of 7.18.

*One institution could not be included in the sample because it did not have enough students to be included in the calculations for the restriction of range corrections.

AP Scores ≥ 3 . This is the number of AP Exams that a student completed and scored at least a 3 or higher on. For the sample, AP Scores ≥ 3 ranged from 0 to 18, with a mean of 2.33 and a standard deviation of 2.37.

AP Proportion. This is the proportion representing the number of AP Exams a student took (AP Exam Count), divided by the number of AP courses offered at his or her high school (AP HS Count). The AP course offerings by high school were obtained from the AP Program at the College Board. The proportion for this sample ranged from 0.03 to 8.00, with a mean of 0.29 and standard deviation of 0.27. Less than one percent of the sample had an AP Proportion value greater than 1.00, representing cases where a student took more AP Exams than the number of courses offered at his or her high school.

AP Average. The AP Average is the average score for all of the AP Exams that a student took. This ranges from 1 to 5, with a mean of 2.85 and standard deviation of 1.07 for the sample.

AP High. This is the highest AP score attained by each student. It ranges from 1 to 5, with a mean of 3.45 and standard deviation of 1.28 for the sample.

AP Low. This is the lowest AP score attained by each student. As was the case for AP Average and AP High, the score scale for AP Low ranged from 1 to 5, with a mean of 2.22 and a standard deviation of 1.08 for the sample.

SAT scores. Official SAT scores were obtained from the College Board. A student's most recent score was used in the analyses. The SAT is composed of three sections, Critical Reading (CR), Math (M), and Writing (W), and the score scale range for each section is 200 to 800. The mean SAT CR score was 582 ($SD = 88$), the mean SAT M score was 603 ($SD = 88$), and the mean SAT W score was 578 ($SD = 88$).

High School GPA (HSGPA). Self-reported HSGPA was obtained from the SAT Questionnaire that students completed during registration for the SAT. This variable is on a 12-point scale ranging from A+ (97–100; 4.33) to E or F (Below 65; 0). The mean HSGPA was 3.73 ($SD = .42$).

Demographic information. Self-reported ethnicity, gender, parental education, and best language were also obtained from student responses to the SAT Questionnaire.

First-Year GPA (FYGPA). Each participating institution supplied FYGPA values for its 2008 first-time, first-year students. The range of FYGPAs across institutions was 0.00 to 4.27.

Procedure

As previously noted, this is an exploratory study intended to provide practical information on potentially useful predictors for college admission professionals. The AP variables of interest in this study included the number of AP Exams taken by a student (AP Exam Count), the number of AP Exam scores a student received that are equal to or greater than a 3 (AP Scores ≥ 3), the proportion of AP Exams taken out of all AP courses offered at the student's high school (AP Proportion), the student's average AP Exam score (AP Average), the student's highest AP Exam score (AP High), and the student's lowest AP Exam score (AP Low). AP Exam Count was included to determine the role of AP participation in predicting FYGPA. Although the AP course count versus the AP Exam count is more typically considered in college admission (Attewell, 2001; Hebel, 1999; Rigol, 2003), the researchers only had access to a self-reported approximation of the student's high school course work from the SAT Questionnaire, but they did have access to actual AP Exam-taking behavior. While a student can take an AP Exam without having taken the associated course, this is not a typical

behavior (Hargrove et al., 2008; Wyatt & Mattern, 2011). Therefore, we believe AP Exam count (AP Exam Count) to be the best available measure to capture general AP participation, and it can provide answers to research questions similarly studied by Geiser and Santelices (2004) regarding the role of the number of AP courses taken in predicting college outcomes. In addition to providing information on academic performance, the AP Exam Count may also include information related to internal motivation to learn (Mason Kiefer, 2004) or greater academic engagement (Donnelly, McCormack, & Rimmer, 2007).

We additionally chose to examine AP Proportion in order to not disadvantage students from high schools offering fewer AP courses, thereby limiting the number of AP courses they can take. This variable also allows us to explore the motivational aspects of AP course or exam taking in a different way because an AP Exam Count of 3 for a student at a high school that offers three AP courses may mean something very different than an AP Exam Count of 3 for a student at a high school offering 30 AP courses. The first hypothetical student took the maximum number of AP courses that he or she could, while the second student had the opportunity to take many more and did not do so for whatever reason.

In order to examine a measure that combines both the count of exams taken by a student with his or her actual performance, we studied the number of AP Exams taken where the student scored a 3, 4, or 5, which would be considered performing well on or passing the exams. The reason for exploring the variable AP Scores ≥ 3 was to follow up on the findings of Mattern et al. (2009) and Geiser and Santelices (2004) to understand whether it may not be mere participation in AP that translates into college outcomes but rather participation with high AP performance.

Also, three variations of AP Exam scores were studied: AP Average, AP High, and AP Low. While Geiser and Santelices (2004) had previously found strong predictive validity for AP Exam scores and second-year GPA in the University of California admission model, they did not explain how they operationalized AP Exam scores. This is important because students can take many different AP Exams (from Physics to French), and students can also major in many different fields in college (from Art History to Agriculture). An average AP Exam score may consist of extensive, disparate information (or simply one exam score), resulting in a potential loss of information about the student. Or, it could be a useful admission measure, similar to HSGPA, where the index consists of a variety of courses and subjects, providing a comprehensive picture of the student (Sadler & Tai, 2007). Shaw et al. (2013) found initial support for using this particular AP predictor in college admission decisions. Students' chosen major or course work in college and their average AP Exam scores may be based on very similar, somewhat similar, or very different, areas of subject-specific knowledge, which would affect the relationship between average AP Exam score and college outcomes. For this reason, we also examined the students' highest and lowest AP Exam scores with FYGPA. Note that if a student only took one AP Exam, this would be the same score for all three measures. Of particular interest was the AP High score because we hypothesized that the student's highest AP score might signal what would be a useful area of study for him or her to pursue in college. There may be a stronger content match between AP High and the college course work that the student undertakes in the first year.

The analyses in the study consisted of descriptive statistics of the sample and the academic variables, including the AP measures, as well as the intercorrelations of all study predictors. The correlation between each of the AP measures and FYGPA was computed, along with the correlation between SAT scores and HSGPA with FYGPA, to compare the relative strength of each predictor. Correlations were computed within-institution, and then the sample size weighted average correlation was computed for the entire sample. The Pearson-Lawley multivariate correction for restriction of range was applied using the national population of 2008 high school graduates who took the SAT and at least one AP Exam (Lawley, 1943; Pearson,

1902). Also, the incremental validity of the AP measures above and beyond the traditional admission measures of SAT and HSGPA to predict FYGPA was examined.

It is useful to note that because this is an AP validity study (for predicting college performance), other variables that have been shown to have a relationship with college performance, including gender, race/ethnicity, or parental education level, are intentionally not included as predictors in this study. The goal of the study is not to develop a model that best accounts for student performance in college, but more specifically to examine the relationship between different AP predictors and FYGPA, independent of the traditional admission measures of SAT and HSGPA. This method is also in keeping with admission practices because the inclusion of demographic variables as quantifiable criteria for selection is commonly avoided and even illegal in some instances (Santos, Cabrera, & Fosnacht, 2010).

Results

Descriptive Statistics

For the overall sample, high schools, on average, had a wide offering of AP courses ($M = 15.14$, $SD = 7.18$). That being said, there was much variability in the number of courses offered as well as variability in student behavior in taking advantage of such opportunities (refer to Table 1). Specifically, students, on average, took three to four AP Exams ($M = 3.51$, $SD = 2.38$). This translated to an average exam proportion of 0.29, indicating that students took about one third of the AP Exams associated with the AP courses offered at their high school. As for AP performance, the average number of AP Exams taken with a score of 3 or higher was 2.33 ($SD = 2.37$), and the average AP Exam score was 2.85 ($SD = 1.07$). The average high and low exam scores were 3.45 ($SD = 1.28$) and 2.22 ($SD = 1.08$), respectively. In terms of SAT performance, the average section scores were 582 for critical reading, 603 for math, and 578 for writing. As for grades earned in high school and college, mean performance was 3.73 for HSGPA and 3.13 for FYGPA.

Table 1 also provides the intercorrelations of study predictors. As expected, most of the predictors were positively correlated with each other, though to varying degrees. For example, AP Average was highly correlated with both AP High (.90) and AP Low (.85). Likewise, the three SAT section scores were highly correlated. AP Proportion had the lowest correlation with the other predictors. Since this variable is a function both of student behavior (number of exams taken) and school rigor (number of exams offered), this result is not very surprising.

Subgroup Differences on AP Measures

Additionally, performance on the various AP measures by subgroup was examined (refer to Table 2). When results were parsed by gender, we found that males had higher performance on all indicators; however, the effect was small as indexed by the standardized difference. For example, males attended high schools with slightly more AP courses offered (15.33 males, 14.99 females) as well as took slightly more AP Exams (3.63 males, 3.41 females). Males also had, on average, a somewhat higher number of AP Scores ≥ 3 (2.52 males, 2.22 females), AP Average score (2.97 males, 2.76 females), AP High score (3.58 males, 3.35 females), and AP Low score (2.31 males, 2.14 females) than females.

In terms of race/ethnicity, Asian students attended high schools that offered more AP courses respective to other groups. They also took more AP Exams ($M = 4.21$) than other racial/ethnic groups, with African American students taking the fewest number of exams ($M = 2.86$). The AP Proportion for all racial/ethnic groups was similar, ranging from 0.28

for African American, Other, and white students up to 0.31 for American Indian students. Excluding students who did not report their race/ethnicity, Asian and white students had the highest AP Average score ($M = 2.96$ and 2.94 , respectively), while African American students had the lowest ($M = 2.10$). AP High scores ranged from 2.55 to 3.65, with Asian students having the highest and African American students the lowest. Asian students also had the highest number of AP Scores ≥ 3 ($M = 2.93$), whereas African American students had the lowest ($M = 1.10$). AP Low mean scores ranged from 1.67 for African American students to 2.31 for white students and 2.36 for students who did not state their ethnicity. These results parallel previous research, which has found that African American students tend to have lower performance on academic measures compared to Asian and white students (Kobrin, Sathy, & Shaw, 2006).

Performance on all of the AP measures was also examined by students' best language. Excluding students who did not report their best language, those students identifying their best language as English and another language attended high schools with the highest mean AP course count (15.35) and also had the largest AP Proportion (0.32). Those indicating a language other than English as their best language had the highest performance on AP Average, AP High, and AP Low. Those stating that their best language was English had the highest number of AP scores equal to or greater than 3 (2.34), excluding students who did not report their best language.

Finally, performance on the AP measures by students' highest parental education level was examined. The results revealed that as highest parental education level increased so did the number of AP courses offered at a student's high school, the total number of AP Exams a student took, the number of exams the student took on which he or she received a score equal to or greater than 3, AP Average score, AP High score, and AP Low score. The AP Proportion was the only variable that did not follow this pattern; specifically, students whose highest parental education level was less than a bachelor's degree had an AP Proportion of 0.30 compared to 0.27 and 0.29 for students whose highest parental education was a bachelor's degree and higher than a bachelor's degree, respectively.

Predictive Validity

Table 3 includes the correlations between each of the AP measures and FYGPA as well as the correlations between SAT scores and HSGPA with FYGPA to compare the relative strength of each predictor. Both observed, or raw, and corrected correlations are reported. Note that the population used in this study is more restricted than what has been used in previous College Board validity reports (e.g., Kobrin, Patterson, Shaw, Mattern, & Barbuti, 2008; Patterson, Mattern, & Kobrin, 2009; Patterson & Mattern, 2011) because students who take an AP Exam in addition to the SAT tend to be more academically able than students who only took the SAT. Therefore, the corrected correlations for the SAT are slightly lower than what has been previously reported (.06–.08 lower). Additionally, Figure 1 displays scatterplots of mean FYGPA by performance on the six AP variables to visually show the relationship between the AP measures and college success.

Among the six AP measures, AP Average and AP High were the most highly correlated with FYGPA, with a corrected correlation of .44, which is higher than the correlations for both SAT-CR and SAT-M with FYGPA and only slightly lower than the correlation between SAT-W and FYGPA. The predictor of AP Scores ≥ 3 also had a strong relationship with FYGPA, with a corrected correlation of .41. AP Proportion had the weakest relationship with FYGPA ($r = .14$), whereas a moderate relationship was found for AP Exam Count ($r = .28$) and AP Low ($r = .31$). Figure 1 corroborates these findings, showing that higher AP performance is associated with

higher FYGPAs, albeit to varying degrees across the six measures. Congruent with previous research, SAT scores and HSGPA were strongly related to FYGPA, with HSGPA having the largest correlation ($r = .47$)

Incremental Validity

The next set of analyses were conducted to determine whether any of the AP measures examined could provide incremental validity in the prediction of FYGPA above and beyond traditional college admission measures of test scores and HSGPA. First, the multiple correlation between the three SAT section scores and HSGPA with FYGPA was computed. As reported in Table 4, the corrected correlation was .56, which again is slightly lower than what has been reported in previous studies examining the predictive validity of the SAT due to differences in the population used to correct for restriction of range (e.g., Kobrin et al., 2008; Patterson et al., 2009; Patterson & Mattern, 2011). Next, the AP measure that contributed most incrementally to the prediction of FYGPA was identified, which was AP Average. When AP Average was added to the model, the change in R^2 was .031. AP Exam Count, AP Scores ≥ 3 , AP Low, AP High, and AP Proportion did not add incrementally (i.e., no change in R to two decimal places) to the prediction of FYGPA after AP Average was included in the model. AP High added the next greatest change in R^2 of .026, followed by AP Low and then AP Scores ≥ 3 , but AP Exam Count and AP Proportion did not add incrementally to SAT and HSGPA to two decimal places.

Discussion

This study explored a number of different AP predictors that explicitly or implicitly took into account motivation, AP participation, performance, or both participation and performance in order to determine how admission staff can make the best use of students' AP Exam data when available to them. Our results showed that, in our sample of more than 100,000 students, the two AP predictors most strongly related to FYGPA were AP Average and AP High, followed by the number of AP scores greater than or equal to 3. When we examined the incremental validity of the different AP predictors above and beyond HSGPA and SAT scores, which are typically considered in admission decisions (Rigol, 2003), to predict FYGPA, we found that the greatest increment in validity was produced by the AP Average variable. This increased the predictive validity of the measures with FYGPA by 0.03. Though this value might seem small to those less familiar with educational measurement, in reality it is particularly difficult to account for additional variance in FYGPA once test scores and HSGPA have been included in the model, as there is only so much of FYGPA that can be explained or predicted by cognitive or academic variables.

An increment of .03 in predicting FYGPA has important ramifications in our understanding students' future performance as evidenced by research showing the "real world" impact of such increases in validity (Bridgeman, Pollack, & Burton, 2008; Mattern, Shaw, & Kobrin, 2011). Figure 2 provides a more concrete example showing the differences in mean FYGPA by AP Average score for all students with a HSGPA equal to or greater than 4.00 and SAT CR+M+W scores equal to or greater than 1800. AP Average scores further differentiate the college performance of these high-achieving students as evidenced by their increasing mean FYGPAs as AP Average scores also increase, from a mean FYGPA of 3.14 for those with an AP Average score of 1 to a mean FYGPA of 3.68 for those with an AP Average score of 5. Other noncognitive variables such as conscientiousness or creativity may provide additional value in predicting FYGPA. However, these types of variables can be difficult to measure and use in high-stakes decision making because an element of fakability or coachability is

often associated with these variables. (Alliger & Dwight, 2000; Hurtz & Alliger, 2002; Ziegler, MacCann, & Roberts, 2011). The AP data discussed in this paper are often readily available to admission staff, and they are standardized measures with strong psychometric credentials (Ewing, Huff, & Kaliski, 2010).

Even though the bivariate correlations for both AP High and AP Average with FYGPA were the same, it is possible that AP Average added the greatest increment in validity to SAT and HSGPA because AP High had a slightly stronger relationship with HSGPA (.34) than AP Average (.31). It is also possible that had the outcome of interest been cumulative GPA in the second or third year of college, AP High or AP Scores ≥ 3 would have added more incremental validity to SAT and HSGPA in the prediction of college GPA. This is because the first year of college typically includes a broad array of general course work, whereas later years in college include more specialized, major-specific course work, which students tend to perform better in due to growth, maturity, and choice of material (Mattern & Patterson, 2011; Strauss & Volkwein, 2002; Theophilides, Terenzini, & Lorang, 1984). In many ways, the AP Average can be considered almost as a standardized HSGPA, providing reliable and sometimes broader information than many of the other AP variables in predicting FYGPA.

That the AP Exam Count and AP Proportion variables did not provide a great deal of information related to FYGPA also offers useful information for admission staff. These variables, whether or not they represent a form of academic motivation, did not seem to strongly relate to FYGPA nor add information above SAT and HSGPA in the prediction of FYGPA. This is in keeping with the findings in Shaw et al. (2013), and it is particularly important to note because currently, AP course-taking information, rather than AP Exam score information, is more readily used to make college admission decisions (Attewell, 2001; Hebel, 1999; Rigol, 2003), though AP Exam score information appears to be more valuable in understanding future college performance. If we return to the earlier example of why we studied the proportion variable, the findings identify that the student who took three AP Exams from a high school that offered only three AP courses was not necessarily more prepared for college or more motivated to perform well in college than the student who took three AP Exams from a high school that offered 30 AP courses. Santoli (2002) similarly noted that students at high schools that offered more AP courses, even if they don't take the AP courses, tend to perform better in college than students at high schools offering fewer AP courses — clearly signaling the role of high school rigor in college preparedness.

There are a few limitations of this study. As previously noted, the authors did not have access to students' high school transcript information, only AP Exam information and the AP courses offered at students' high schools. Determinations as to those students who had taken the AP course but not the exam and the role that this may play in predicting FYGPA is not clear. Similarly, students can take the exam and not the course, though previous research has shown that there are not many students who do this (Hargrove et al., 2008; Wyatt & Mattern, 2011).

Finally, because this was an exploratory study, there are a number of areas where future research would be helpful. It would be useful to examine whether the AP Average variable is as predictive of FYGPA for students with one AP Exam score versus three AP Exam scores. It would also be important to study the differential validity of the AP Average variable with FYGPA by gender, ethnicity, and best language. It would be useful to study how the use of AP Exam information in admission decisions can impact the diversity of an incoming class. Ultimately, prior to implementing the use of AP Exam information into an admission process, it would be important for institutions to conduct their own admission validity studies to better understand the relationship of AP Exam variables with FYGPA at their institution.

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Table 1.
Descriptive Statistics of Study Variables

#	Predictor	Mean	SD	1	2	3	4	5	6	7	8	9	10
1	AP Exam Count	3.51	2.38	–	(0.80)	(0.41)	(0.24)	(0.47)	(-0.12)	(0.31)	(0.29)	(0.29)	(0.17)
2	AP Scores ≥ 3	2.33	2.37	0.82	–	(0.28)	(0.63)	(0.70)	(0.31)	(0.50)	(0.43)	(0.46)	(0.21)
3	AP Proportion	0.29	0.27	0.41	0.31	–	(0.04)	(0.17)	(-0.12)	(0.13)	(0.08)	(0.10)	(0.21)
4	AP Average	2.85	1.07	0.33	0.67	0.12	–	(0.87)	(0.83)	(0.52)	(0.45)	(0.47)	(0.19)
5	AP High	3.45	1.28	0.53	0.73	0.22	0.90	–	(0.52)	(0.50)	(0.44)	(0.46)	(0.20)
6	AP Low	2.22	1.08	-0.03	0.37	-0.04	0.85	0.59	–	(0.35)	(0.30)	(0.31)	(0.10)
7	SAT-CR	582	88	0.42	0.59	0.21	0.59	0.59	0.40	–	(0.45)	(0.69)	(0.16)
8	SAT-M	603	88	0.42	0.56	0.18	0.54	0.55	0.36	0.65	–	(0.46)	(0.20)
9	SAT-W	578	88	0.42	0.58	0.19	0.57	0.57	0.38	0.81	0.66	–	(0.20)
10	HSGPA	3.73	0.42	0.30	0.34	0.24	0.31	0.34	0.18	0.35	0.41	0.39	–

Note: $N = 100,623$. Pooled within-institution, restriction of range-corrected correlations are presented below the main diagonal. The raw correlations are provided above the main diagonal in parentheses.

Table 2.

Subgroup Differences by AP Measures

Student Characteristics	AP HS Count			AP Exam Count			AP Scores ≥ 3			AP Proportion			AP Average			AP High			AP Low			
	Mean	SD	d	Mean	SD	d	Mean	SD	d	Mean	SD	d	Mean	SD	d	Mean	SD	d	Mean	SD	d	
Gender	Male	15.33	7.20	0.03	3.63	2.51	0.05	2.55	2.52	0.09	0.29	0.28	0.00	2.97	1.09	0.11	3.58	1.29	0.10	2.31	1.11	0.08
	Female	14.99	7.15	-0.02	3.41	2.26	-0.04	2.15	2.22	-0.08	0.28	0.26	-0.04	2.76	1.05	-0.08	3.35	1.27	-0.08	2.14	1.06	-0.07
Race/ Ethnicity	African American	14.28	7.28	-0.12	2.86	1.96	-0.27	1.10	1.66	-0.52	0.28	0.29	-0.04	2.10	0.96	-0.70	2.55	1.22	-0.70	1.67	0.89	-0.51
	American Indian	13.87	7.26	-0.18	3.14	2.26	-0.16	1.74	2.07	-0.25	0.31	0.35	0.07	2.61	1.07	-0.22	3.12	1.28	-0.26	2.08	1.07	-0.13
Other	Asian	16.40	7.32	0.18	4.21	2.76	0.29	2.93	2.82	0.25	0.30	0.25	0.04	2.96	1.09	0.10	3.65	1.29	0.16	2.21	1.11	-0.01
	Hispanic	14.71	6.86	-0.06	3.63	2.40	0.05	1.73	2.02	-0.25	0.30	0.27	0.04	2.47	1.03	-0.36	3.25	1.34	-0.16	1.82	1.03	-0.37
	Other	15.47	7.09	0.05	3.59	2.42	0.03	2.38	2.46	0.02	0.28	0.24	-0.04	2.84	1.09	-0.01	3.42	1.29	-0.02	2.20	1.10	-0.02
	White	15.03	7.16	-0.02	3.41	2.30	-0.04	2.39	2.31	0.03	0.28	0.26	-0.04	2.94	1.05	0.08	3.51	1.25	0.05	2.31	1.07	0.08
	Not Stated	15.14	7.08	0.00	3.65	2.38	0.06	2.65	2.45	0.14	0.30	0.33	0.04	3.03	1.06	0.17	3.62	1.23	0.13	2.36	1.10	0.13
Best Language	English Only	15.13	7.17	0.00	3.48	2.36	-0.01	2.34	2.37	0.00	0.28	0.26	-0.04	2.86	1.07	0.01	3.44	1.27	-0.10	2.23	1.08	0.01
	English and Another	15.35	7.20	0.03	3.94	2.63	0.18	2.22	2.45	-0.05	0.32	0.29	0.11	2.68	1.07	-0.16	3.50	1.34	0.04	1.95	1.09	-0.25
	Another Language	14.41	7.39	-0.10	2.99	2.10	-0.22	1.89	1.91	-0.19	0.28	0.32	-0.04	3.00	1.25	0.14	3.68	1.43	0.18	2.35	1.36	0.12
	Not Stated	15.70	7.21	0.08	3.58	2.36	0.03	2.44	2.38	0.05	0.29	0.33	0.00	2.89	1.07	0.04	3.51	1.27	0.05	2.24	1.08	0.02
Highest Parental Education	< B.A.	13.07	6.92	-0.29	3.06	2.17	-0.19	1.55	1.91	-0.33	0.30	0.29	0.04	2.46	1.04	-0.36	3.02	1.30	-0.34	1.93	1.02	-0.27
	B.A.	15.50	7.17	0.05	3.43	2.33	-0.03	2.29	2.29	-0.02	0.27	0.25	-0.07	2.86	1.05	0.01	3.45	1.25	0.00	2.23	1.07	0.01
	> B.A.	16.24	7.05	0.15	3.88	2.50	0.16	2.89	2.55	0.24	0.29	0.26	0.00	3.11	1.03	0.24	3.75	1.20	0.23	2.39	1.09	0.16
No Response	14.92	7.18	-0.03	3.52	2.39	0.00	2.35	2.42	0.01	0.30	0.28	0.04	2.86	1.12	0.01	3.46	1.32	0.01	2.22	1.12	0.00	

Note: The standardized difference (*d*) is calculated as (Subgroup Mean minus Total Mean)/Total Standard Deviation.

Table 3.

Raw and Corrected Correlations Between Predictors and FYGPA

Predictor	Raw	Corrected
AP Exam Count	0.19	0.28
AP Scores ≥ 3	0.32	0.41
AP Proportion	0.08	0.14
AP Average	0.37	0.44
AP High	0.35	0.44
AP Low	0.26	0.31
SAT-CR	0.28	0.40
SAT-M	0.27	0.40
SAT-W	0.34	0.45
HSGPA	0.35	0.47

Note: $N = 100,623$. Pooled within-institution, restriction of range-corrected and raw correlations are provided.

Table 4.

Incremental Validity of AP Measures Above and Beyond SAT and HSGPA to Predict FYGPA

Base Model	Predictor of Interest	R (raw)	ΔR^2
HSGPA, SAT-CR, SAT-M, SAT-W		.557 (.456)	
HSGPA, SAT-CR, SAT-M, SAT-W	AP Average	.584 (.493)	.031 (.035)
HSGPA, SAT-CR, SAT-M, SAT-W	AP High	.580 (.484)	.026 (.026)
HSGPA, SAT-CR, SAT-M, SAT-W	AP Low	.571 (.475)	.016 (.018)
HSGPA, SAT-CR, SAT-M, SAT-W	AP Scores ≥ 3	.570 (.472)	.014 (.015)
HSGPA, SAT-CR, SAT-M, SAT-W	AP Exam Count	.558 (.458)	.001 (.002)
HSGPA, SAT-CR, SAT-M, SAT-W	AP Proportion	.557 (.457)	.000 (.000)

Note: $N = 100,623$. Restriction of range-corrected correlations are provided. Raw correlations are reported in parentheses. AP Exam Count, AP Scores ≥ 3 , AP Low, AP High, and AP Proportion did not add incrementally (i.e., no change in R to two decimal places) to the prediction of FYGPA after AP Average was included in the model.

Figure 1. Scatterplots of mean FYGPA by the six AP variables. Clockwise from upper left quadrant: Mean FYGPA by AP High and AP Low scores; Mean FYGPA by Average AP Score; Mean FYGPA by count of AP scores ≥ 3 and AP Exam count overall; and Mean FYGPA by AP Proportion. AP Counts (AP scores ≥ 3 and AP Exam count overall) with fewer than 15 students are not plotted.

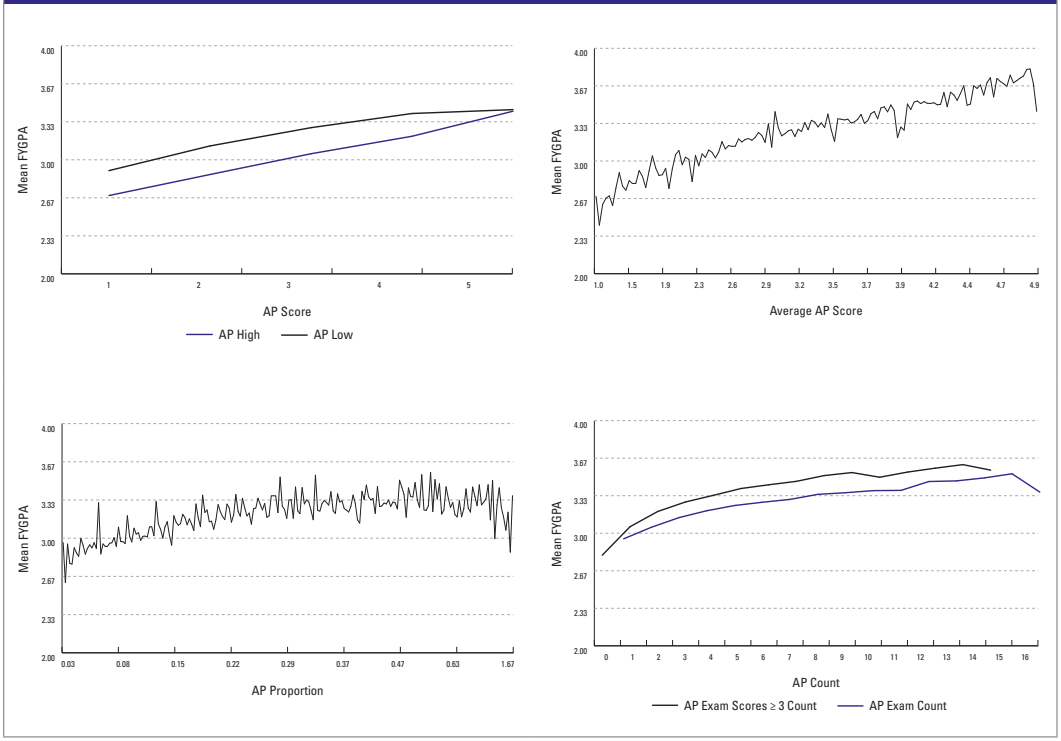
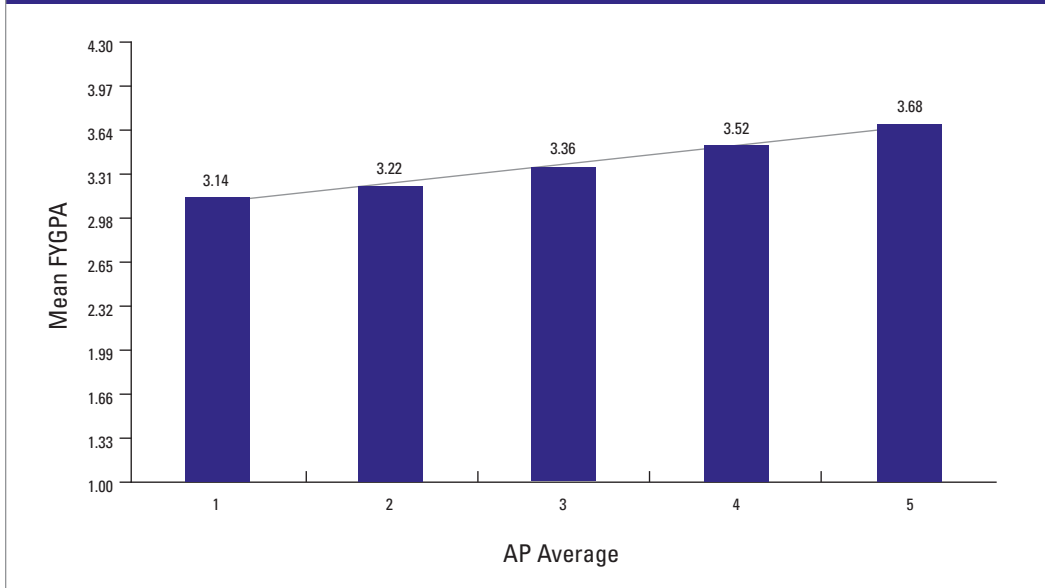


Figure 2.

Mean FYGPA by AP Average Score for all students with a HSGPA ≥ 4.00 and SAT CR+M+W ≥ 1800 . As AP Average Scores increase, the mean FYGPA also increases. Note the AP Average scores included in each AP Average score category: 1 = 1.00 1.49; 2 = 1.50 2.49; 3 = 2.50 3.49; 4 = 3.50 4.49; 5 = 4.50 5.00.



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