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How Useful Are Traditional Admission Measures in Predicting Graduation Within Four Years?

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Executive Summary

Research has consistently shown that traditional admission measures — SAT® scores and high school grade point average (HSGPA) — are valid predictors of early college performance such as first-year grades; however, their usefulness to predict later college outcomes has been questioned, especially for the SAT. This study builds on previous research showing that both SAT scores and HSGPA are predictive of a more distal measure of college success — college graduation within four years. Moreover, each measure provided unique information to the prediction of graduation, indicating the utility of using both measures in the admission process to select applicants who are most likely be successful. Finally, the relationships between SAT and HSGPA with four-year graduation rates by institutional control and selectivity (i.e., undergraduate admittance rate) were also investigated. The findings demonstrate the usefulness of traditional admission measures for predicting long-term college outcomes.

Introduction

The majority of research examining the validity of the SAT for use in college admission has focused on grades earned in the first year of college as the college outcome (e.g., Berry & Sackett, 2009; Bridgeman, McCamley-Jenkins, & Ervin, 2000; Burton & Ramist, 2001; Fishman & Pasanella, 1960; Hezlett et al., 2001; Kobrin, Patterson, Shaw, Mattern, & Barbuti, 2008; Mattern, Patterson, Shaw, Kobrin, & Barbuti, 2008; Patterson & Mattern, 2011; Patterson, Mattern, & Kobrin, 2009; Young, 2001); however, it has been argued that a more vital indicator of college success is whether a student earns a college degree (Bowen, Chingos, & McPherson, 2009). Specifically, Bowen et al. (2009) stressed that the conversation needs to move beyond college enrollment to college completion. Given the intrinsic interplay between the educational level of the United States (U.S.) population and economic prosperity of the U.S., it is not surprising that a renewed focus on college completion has been seen in not only the education sector but also the political sector. Specifically, on Feb. 24, 2009, President Barack Obama issued a college completion goal, referred to as the American Graduation Initiative, that "by 2020, America will once again have the highest proportion of college graduates in the world." Currently, the U.S. is ranked 12th globally in terms of the percentage of 25- to 29-year-olds holding an associate degree or higher (College Board, 2010).

Concern over the level and quality of education that the United States' youth receive is warranted in light of the current state of affairs. According to the U.S. Census Bureau (2010), in 2009, most (86.7%) individuals ages 25 or older had graduated high school but only a little over half (55.6%) had some college experience. In terms of college completion, only 29.5% had a bachelor's degree or higher. The college completion statistics are even more alarming for underrepresented students and students from low-socioeconomic status (SES) families. These results underscore the need to better prepare our youth for the challenging and rigorous demands of college-level work so that they are more likely to succeed and stay in college through degree completion.

With this in mind, the purpose of this study was to evaluate the usefulness of SAT scores to determine which students are likely to graduate from college, and in a timely manner (i.e., within four years). If SAT scores are predictive of college graduation, then these results will provide additional evidence in support of using SAT scores as part of the college admission process. Additionally, these findings could inform the current dialogue about college readiness by leveraging SAT scores to identify higher- and lower-performing schools, districts, or states and potentially either find exemplars or determine where additional resources should be directed to help achieve the goal set forth by the president (refer to Wyatt, Kobrin, Wiley, Camara, and Proestler, 2011, for a more in-depth discussion on the use of SAT scores to determine college readiness).

Previous Research

Given the importance of college completion not only to the individual student but also for the economic sustainability of the country as a whole, it is not surprising that a great deal of research has been devoted to studying the topic of college retention over the past 30 years. Perhaps the most well-known theory of college retention, Tinto's (1993) theory of individual departure delineates the decision to leave an institution as a longitudinal process in which student-level variables (or pre-entry attributes) and the complex interplay with college experiences influence students' academic and social attachment to their respective colleges, which in turn influences the likelihood of departing from that college.

Pre-entry attributes that have shown the most promise for explaining the college retention process include academic preparation (Allen, 1999; Allen, Robbins, Casillas, & Oh, 2008; Astin, 1997; Attewell, Heil, & Reisel, 2011; Bowen et al., 2009; Mattern & Patterson, 2009; Murtaugh, Burns, & Schuster, 1999; Robbins, Lauver, Le, Davis, & Langley, 2004; Tinto, 1993), gender (Astin, 1975; Bowen et al., 2009; Leppel, 2002; Peltier, Laden, & Matranga, 1999), racial or ethnic identity (Allen, 1999; Astin, 1975; Bowen et al., 2009; Keller, 2001; Murtaugh, Burns, & Schuster, 1999; Pascarella & Terenzini, 1991), SES (Allen, 1999; Attewell et al., 2011; Bowen & Bok, 1998; Bowen et al., 2009; Cabrera, Nora, & Castaneda, 1992; Howard, 2001; Hoyt & Winn, 2004; Robbins et al., 2004), and nontraditional status (e.g., delayed enrollment, part-time enrollment) (Astin, 1997; Keller, 2001; Murdock & Hoque, 1999; Tinto, 1993).

Given the focus of this study on the relationship between SAT performance and college graduation, a review of the research examining the relationship between academic preparation and college retention is particularly relevant. Additionally, of all the relevant pre-entry attributes, research has consistently shown that academic preparedness is the strongest indicator of college retention. Allen (1999) found that of all the variables examined, first-year grade point average (FYGPA) followed by high school rank had the highest correlations with retention to the second year, though standardized test scores were not included in the study. Murtaugh et al. (1999) found that Allen's (1999) findings extended to more distal outcomes, with high school grade point average (HSGPA) and first-quarter college GPA remaining the strongest predictors in their model of withdrawal over four years. Additionally, SAT scores were positively related to retention, with research on the most recent version of the SAT corroborating these findings (Mattern & Patterson, 2009, 2011a, 2011c, 2011e).

Mattern and Patterson (2009) found that only 64% of students in the lowest SAT score band returned for their second year, compared to 96% of students in the highest SAT score band. The relationship between SAT performance and retention to the third and fourth years was also examined, and similar results were found (Mattern & Patterson, 2011c, 2011e). Students with higher SAT scores were more likely to return for subsequent years of college, even when holding constant key demographic variables (gender, race/ethnicity, parental education, and household income) and HSGPA. Research has also shown that SAT scores predict graduation about as well as HSGPA predicts graduation. Burton and Ramist (2001) found that high school record had an uncorrected correlation of .29 with college graduation, while each of the individual SAT sections (verbal and mathematics) had an uncorrected correlation of .27, and the best combination of the two sections had a correlation of .33.

Research has also shown that SAT scores add incrementally to the prediction of college graduation above and beyond HSGPA (Astin, Tsui, & Avalos; 1996; Bowen et al., 2009). Astin et al. (1996) found that 80% of students with an HSGPA equivalent to an A who had an SAT score of 1300 or greater (on the mathematics and verbal sections combined) graduated in four years, compared to only 28% of those students who had an SAT score of less than 700. When analyzing public institutions, Bowen et al. (2009) also found a small but unique contribution of the previous version of the SAT to the prediction of college graduation. Given the fact that recent validity research on the SAT has found that of the three sections, the writing section is most predictive of performance in the first year of college (Kobrin et al., 2008; Mattern et al., 2008; Patterson & Mattern, 2011; Patterson et al., 2009), the relationship between SAT scores and college graduation should be reevaluated using more recent data, which is a major impetus of the current study.

Based on previous college retention findings, it was expected that SAT scores would influence graduation indirectly through its effects on college grades. As previously noted, retention research has found that college GPA is one of the strongest predictors of college

retention (Allen, 1999; Murtaugh et al., 1999), and one of the strongest predictors of first-year grades is SAT scores (Berry & Sackett, 2009; Bridgeman et al., 2000; Burton & Ramist, 2001; Fishman & Pasanella, 1960; Hezlett et al., 2001; Kobrin et al., 2008; Mattern et al., 2008; Morgan, 1989; Patterson et al., 2009; Patterson & Mattern, 2011; Young, 2001). In other words, students with higher SAT scores are more likely to perform well in college, and students who perform well in college are more likely to be retained.

Though not backed by empirical research, it stands to reason that college grades earned in subsequent years would be even more predictive of retention to later years and ultimately graduation than first-year grades, given the closer proximity in time. Research examining the relationship between SAT scores and second-, third-, and fourth-year cumulative GPA has found that the SAT becomes slightly more predictive of college grades as students progress in their college career, overwhelmingly refuting critics' claims that the SAT is only predictive of FYGPA (Mattern & Patterson, 2011b, 2011d, 2011f). Taken together, the research suggests that students with higher SAT scores are more likely to be successful in college, both in terms of grades and retention.

Current Study

The current study builds on previous SAT validity research by examining the relationship between SAT scores and another — perhaps the most important — dimension of college success: college graduation. Unlike the majority of the retention studies, which evaluate complex, multidimensional models of student retention, it should be reiterated that this study is an examination of the validity of the SAT for predicting college graduation. Therefore, even though research has shown that other student-level variables such as gender, ethnicity, and SES are related to retention, we intentionally excluded those variables as predictors in our model, knowing that omitted variable bias may be present to a limited extent. In other words, we were not trying to create a model that best accounts for student retention but rather wanted to understand the relationship between SAT scores and graduation in addition to whether SAT scores contribute independently to the prediction of graduation above and beyond HSGPA. The focus of this paper is also in alignment with current college admission practices, in that test scores and high school grades were rated by admission professionals as the most important criteria when admitting applicants (NACAC, 2008). Including demographic factors such as race/ethnicity in the admission process is often avoided, and some practices are viewed as unconstitutional. That being said, we have disaggregated results by institutional characteristics based on previous research that has revealed large differences in graduation rates for private versus public institutions and by institutional selectivity (Astin, 1975; Bowen

The current study builds on previous SAT validity research by examining the relationship between SAT scores and another — perhaps the most important — dimension of college success: college graduation.

& Bok, 1998; Bowen et al., 2009). By doing so, the results have shed light on the SAT–graduation relationship at different types of institutions of higher education.

Method

Sample

As part of a larger research endeavor, colleges and universities provided the College Board with college outcome data for students entering college in the fall of 2006. Of the original 110 institutions that provided first-year data on their 2006 cohort, 55 institutions continued to provide data on an annual basis through students' fourth year of college, enabling us to track these students longitudinally. One such institution specialized in a joint bachelor's and professional degree program, where the duration to complete the degree is longer than the traditional four years, and as such was removed from the final sample. Table 1 shows the distribution of the sample of 54 institutions by region of the country, control, size, and selectivity, revealing diversity in the types of institutions that were included in the analyses. The institutional characteristics of the original 110 institutions are also provided and reveal similar distributions on these key factors for the two samples. Data provided by each institution included the students' course work, course grades, college GPA, and annual retention/graduation information. The data set included 96,393 students; however, only students who had completed data on key variables (SAT scores, HSGPA, and graduation), were included in the analyses, resulting in a final sample size of 78,990. Of the 17, 403 students excluded from analyses, the removal of the one institution accounted for 246 students (1.4%). The majority of students (N = 13,229 students, 76.0%) were removed because they did not have SAT scores (i.e., ACT- or non-test-takers). Since the focus of the current study is on the validity of the SAT for predicting college success, the removal of these students did not compromise the generalizability of the results. The remaining 3,928 students (22.6%) who were removed did not report their HSGPA.

Table 1.

Comparison of the Institutional Characteristics of the Original 2006 Sample and Current Study Sample

Institutional Characteristic		Original Sample (k = 110)	Current Study (k = 54)
U.S. Region	Midwest	15%	13%
	Mid-Atlantic	24%	19%
	New England	22%	22%
	South	11%	13%
	Southwest	11%	9%
	West	17%	24%
Control	Public	43%	41%
	Private	57%	59%
Size (number of undergraduates)	Small (750 to 1,999)	20%	19%
	Medium (2,000 to 7,499)	39%	37%
	Large (7,500 to 14,999)	21%	24%
	Very Large (15,000 or more)	20%	20%
Selectivity (undergraduate admittance rate)	< 50%	24%	20%
	50–75%	54%	54%
	> 75%	23%	26%

Note: k = number of institutions

Measures

SAT scores. Official SAT scores obtained from the 2006 College-Bound Seniors cohort database were used in the analyses. This database includes students who participated in the SAT Program and were expected to graduate from high school in 2006. Students' most recent scores were used in the analyses. The SAT is made up of three sections — critical reading, mathematics, and writing — and the score scale range for each section is 200 to 800. The composite of the three SAT sections score (henceforth referred to as the "SAT composite score") was used in the analyses. Typically, the three sections are entered separately when they serve as predictors; however, SAT composite scores were used to align with research on identifying students who are college ready (Wyatt et al., 2011) and to provide practical, straightforward information to college admission professionals. Additional analyses were run to evaluate the decision to use the composite of the three SAT sections, and the results supported this decision.[1]

SAT-Questionnaire responses. HSGPA data were obtained from the SAT-Questionnaire that students completed during registration for the SAT.

Graduation. Each participating institution indicated whether their 2006 first-time first-year students had earned bachelor's degrees by the end of the spring 2010 semester.

1. To empirically evaluate the validity of using the SAT composite score, a separate model was run with each SAT section score entered separately as predictors. This model was compared to the SAT composite model, and similar information criteria and classification accuracy values were obtained that supported the decision to report on the less complex SAT composite model.

Analysis

HGLM

Due to the structure of our data with students nested within colleges and universities, we employed hierarchical generalized linear modeling (HGLM) to estimate the relationship between SAT scores and graduation in four years of college. HGLM was used rather than standard hierarchical linear modeling (HLM) because the outcome variable — graduation — is not continuous but discrete, with only two possible values: 0 (i.e., did not graduate within four years) or 1 (i.e., graduated within four years). Given the constrained range of values, rather than model graduation directly, the HGLM with a binary outcome in effect models the natural logarithm of the odds (i.e., the logit) of having graduated within four years. Expressed symbolically:

$$Pr\left(Y_{ij}=1\boldsymbol{\beta}_j\right)=\phi_{ij} \tag{1}$$

$$log\,\phi_{ij}\,/\left(1-\phi_{ij}\right)=\eta_{ij} \tag{2}$$

where Y_{ij} is the four-year graduation indicator, $\boldsymbol{\beta}_j$ is the vector of model parameters for institution j, ϕ_{ij} is the probability of studend i attending school j having graduated in four years, log(•) is the natural logarithm and η_{ij} is the the corresponding logit of that probability. The GLIMMIX procedure in Version 9.2 of the SAS System was used, and estimation was performed using a Laplace approximation to maximum likelihood (SAS Institute Inc., 2008).

A series of models were estimated to evaluate the impact that adding various predictors to the model had on overall model fit as indexed by Akaike Information Criterion (AIC) and classification accuracy. A null model (i.e., Model 1), which included no random effects and served as a baseline against which to judge more complex models, was estimated. Table 2 provides the equations and parameters to be estimated for each model examined. In order to demonstrate the need for a multilevel model, and because the standard intraclass correlation (ICC) is not appropriate with discrete dependent variables such as graduation, we calculated a generalized ICC statistic proposed by Commenges and Jacqmin (1994). Next, we included a random intercept effect for college (i.e., Model 2) to determine the appropriateness of multilevel modeling. For Models 3 and 4, SAT and HSGPA were included as Level 1 predictors, respectively, to evaluate their independent effects on graduation, whereas Model 5 included both predictors in order to evaluate their combined effect. Finally, Model 6 examined whether some portion of variation in baseline four-year graduation rates could be explained by including control (i.e., public, private) and selectivity (i.e., admittance rate) as Level 2 predictors.

Table 2.

Level 1 and Level 2 Equations for the HLGMs

Model	Level 1 Equations	Level 2 Equations
Model 1	$Pr\left(Graduate_{ij}=1\mid\boldsymbol{\beta}_j\right)=\phi_{ij}$ $log\ \phi_{ij}/(1-\phi)=\eta_{ij}$ $\eta_{ij}=\beta_{0j}$	$\beta_{0j}=\gamma_{00}$
Model 2	$Pr\left(Graduate_{ij}=1\mid\boldsymbol{\beta}_j\right)=\phi_{ij}$ $log\ \phi_{ij}/(1-\phi)=\eta_{ij}$ $\eta_{ij}=\beta_{0j}$	$\beta_{0j}=\gamma_{00}+u_{0j}$
Model 3	$Pr\left(Graduate_{ij}=1\mid\boldsymbol{\beta}_j\right)=\phi_{ij}$ $log\ \phi_{ij}/(1-\phi)=\eta_{ij}$ $\eta_{ij}=\beta_{Oj}+\beta_{1j}*\left(SAT_{ij}\right)$	$\beta_{0j}=\gamma_{00}+u_{0j}$ $\beta_{1j}=\gamma_{10}$
Model 4	$Pr\left(Graduate_{ij}=1\mid\boldsymbol{\beta}_j\right)=\phi_{ij}$ $log\ \phi_{ij}/(1-\phi)=\eta_{ij}$ $\eta_{ij}=\beta_{Oj}+\beta_{1j}*\left(HSGPA_{ij}\right)$	$\beta_{0j}=\gamma_{00}+u_{0j}$ $\beta_{1j}=\gamma_{10}$
Model 5	$Pr\left(Graduate_{ij}=1\mid\boldsymbol{\beta}_j\right)=\phi_{ij}$ $log\ \phi_{ij}/(1-\phi)=\eta_{ij}$ $\eta_{ij}=\beta_{Oj}+\beta_{1j}*\left(SAT_{ij}\right)+\beta_{2j}*\left(HSGPA_{ij}\right)$	$\beta_{0j}=\gamma_{00}+u_{0j}$ $\beta_{1j}=\gamma_{10}$ $\beta_{2j}=\gamma_{20}$
Model 6	$Pr\left(Graduate_{ij}=1\mid\boldsymbol{\beta}_j\right)=\phi_{ij}$ $log\ \phi_{ij}/(1-\phi)=\eta_{ij}$ $\eta_{ij}=\beta_{0j}+\beta_{1j}*\left(SAT_{ij}\right)+\beta_{2i}*\left(HSGPA_{ij}\right)$	$\beta_{0j}=\gamma_{00}+\gamma_{01}*\left(AdmittanceRate_j\right)+\gamma_{02}*\left(Public_j\right)+u_{0j}$

Note: SAT, HSGPA, and admittance rate were grand-mean centered. u_{0j} denotes the random intercept effect for college *j* and is expected to be normally distributed with mean zero and variance τ_{00}.

Results

Descriptive Statistics

The mean and standard deviation of study variables are provided in Table 3. For the student-level variables, half of the sample graduated within four years; the national average is 36% for four-year institutions (Horn, 2010). The average HSGPA was 3.62, which translates to an A-, and the average SAT composite score was 1705. As for the institutional variables, 22 (41%) of the 54 institutions were publicly controlled, and the average admittance rate was 62% but varied widely, from 19% (very selective) to 94% (nearly open admission).

Table 3.

Descriptive Statistics of Study Variables

Level 1 Descriptive Statistics					
Variable	***N***	***M***	***SD***	***Min***	***Max***
HSGPA	78,990	3.62	0.50	0	4.33
SAT Composite Score	78,990	1705	250	680	2400
Four-Year Graduation Indicator	78,990	0.50	0.50	0	1
Level 2 Descriptive Statistics					
Variable	***N***	***M***	***SD***	***Min***	***Max***
Undergraduate Admittance Rate	54	0.62	0.17	0.19	0.94
Institution Control = Public	54	0.41	0.50	0	1

Though the observed graduation rate was 50% for the total sample, we did find substantial variation when we calculated it by SAT score band. For example, only 18% of students with an SAT composite score between 600 and 890 graduated in four years, compared to 75% of students with an SAT composite score of 2100 or higher (see Figure 1). Even when holding constant a student's HSGPA, a positive trend between SAT scores and four-year graduation rates is apparent; however, the relationship appears weaker for students with a HSGPA equivalent to a C or lower (see Figure 2). The descriptive statistics provide initial support for the positive relationship between SAT scores and college graduation, even after having accounted for HSGPA.

... only 18% of students with an SAT composite score between 600 and 890 graduated in four years, compared to 75% of students with an SAT composite score of 2100 or higher.

Figure 1.

Observed four-year graduation rates by SAT score band.

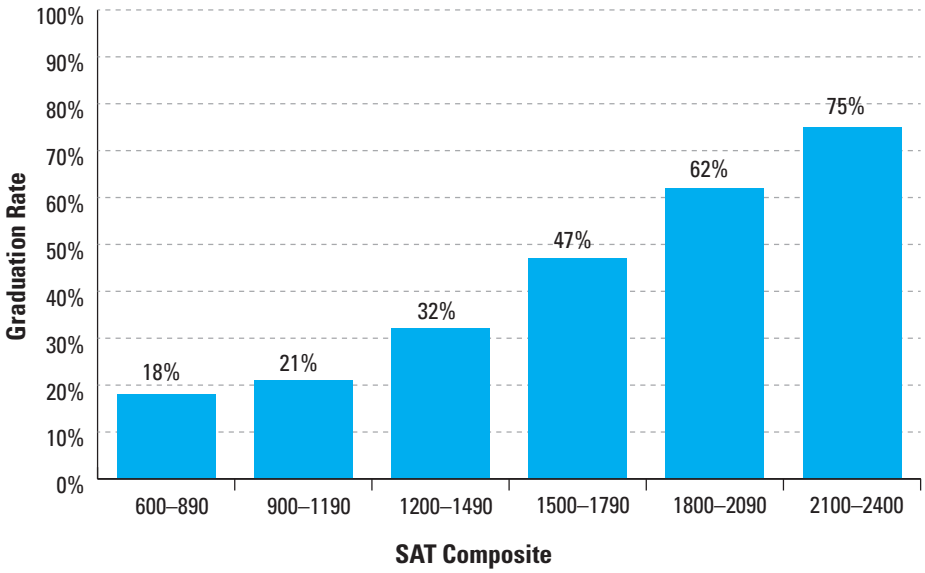
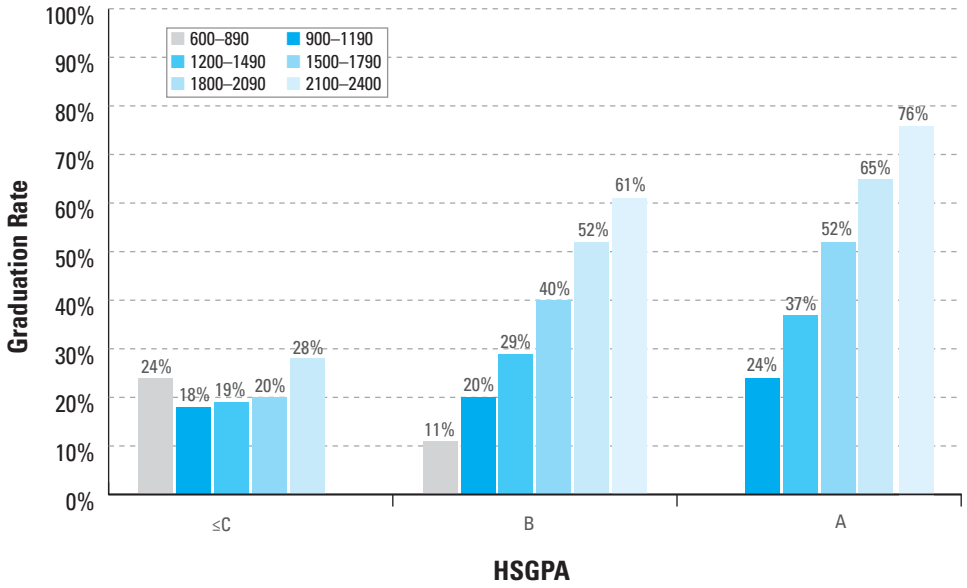


Figure 2.

Observed four-year graduation rates by SAT score band holding constant HSGPA.



HGLM Results

To supplement the descriptive results, HGLM was employed to model the relationship between SAT scores and college graduation. For Model 1 — the null model — which did not include any predictors or random effects for college, predicted that a student has a 50-50 chance of graduating in four years $(\hat{\gamma}_{00} = -8.10 - 04, p = .909)$. Additionally, the model correctly classified 50% of the sample. This is unsurprising because it attributed about a 50% probability of graduating to all students, and about 50% did in fact graduate. The generalized ICC proposed by Commenges and Jacqmin (1994), which is a test of heterogeneity of proportions whose statistic follows a standard normal distribution under the null hypothesis of homogeneous proportions, was calculated. The estimated test statistic was significant ($p < .001$), leading us to reject the null hypothesis of homogeneity of graduation rates across institutions. Motivated by this result, a random intercept effect for institutions was added to the model (Model 2). The random intercept for institutions increased classification accuracy to 66.8% and reduced the AIC from 109,505 to 95,701 by adding only a single parameter. This provided support for using HGLM to model the data in the forms of statistical significance, information theoretic model fit, and improvements in classification accuracy.

Next, we proceeded to add Level 1 predictors to the model. For Model 3, the independent effect of SAT on graduation was evaluated. As shown in Table 4, the fixed parameter estimate for SAT was positive and significant $(\hat{\gamma}_{10} = 1.32\text{E}{-}03, p < .001)$, indicating that students with higher SAT scores have a higher probability of graduating in four years. Further evidence was provided by the AIC, which went down appreciably with the inclusion of SAT scores, along with the increase in classification accuracy. The expected probabilities of graduating in four years for various levels of SAT performance are summarized in Table 5 to illustrate the marginal effect of a given increase in SAT composite scores on expected change in probability of graduating. Students with the lowest possible SAT composite score (i.e., 600) have an expected 23% probability of graduating in four years, compared to 76% for students with the highest possible SAT score (i.e., 2400). Students in this sample with an average composite SAT score (i.e., 1705) had a 56% probability of graduating in four years. Values for two standard deviations above and below the mean are also provided. The results clearly illustrate that SAT performance differentiates students in terms of their likelihood of graduating in four years.

Table 4.

HGLM Parameter Estimates, Information Criteria, and Classification

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
Fixed Parameter Estimates	**Est.**	***p***	**Est.**	***p***	**Est.**	***p***	**Est.**	***p***	**Est.**	***p***	**Est.**	***p***
Intercept	–8.10E–04	.909	2.34E–01	.118	2.53E–01	.052	2.70E–01	.056	2.78E–01	.031	6.94E–01	< .001
HSGPA[a]							7.51E–01	< .001	6.35E–01	< .001	6.34E–01	< .001
SAT Composite Score[a]					1.32E–03	< .001			9.85E–04	< .001	9.81E–04	< .001
Institution Control = Public											–1.02E+00	< .001
Undergraduate Admittance Rate[a]											–2.35E+00	< .001
Random Parameter Estimates												
Intercept Variance			1.16E+00		8.62E–01		1.02E+00		8.41E–01		2.95E–01	
Information Criteria and Classification												
AIC (model parameters)	109,505	(2)	95,701	(3)	94,513	(4)	93,957	(4)	93,351	(5)	93,300	(7)
BIC	109,515		95,705		94,519		93,963		93,359		93,312	
Classification Accuracy (Precision)	50.0%	n/a	66.8%	(65.4%)	68.0%	(68.4%)	67.9%	(67.8%)	68.4%	(68.8%)	68.4%	(68.8%)

Note: *N*= 78,990; *k* = 54; AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion.
[a] Variable was grand-mean centered.

Similar to Model 3, Model 4 evaluated the independent effect of HSGPA on four-year graduation rates. The fixed parameter estimate for HSGPA was positive and significant graduation rates. The fixed parameter estimate for HSGPA was positive and significant $(\hat{\gamma}_{10} = 7.51\mathrm{E}-01, p < .001)$, indicating that students with higher HSGPAs had a higher expected probability of graduating in four years. The expected probabilities of graduating in four years for various levels of HSGPA are summarized in Table 5. Students with the lowest HSGPA (i.e., 0) had an expected 8% probability of graduating in four years, compared to 69% for students with the highest possible HSGPA (i.e., 4.33). Students with an average HSGPA (i.e., 3.62) had a 57% probability of graduating in four years. Values for two standard deviations above and below the mean are also provided. Note that two standard deviations above the mean for HSGPA falls outside the range of possible values and therefore was not reported. As was the case for the SAT, HSGPA clearly differentiates students in terms of their likelihood of graduating in four years.

Table 5.

Expected Probability of Graduating in Four Years for the SAT- and HSGPA-Only Models

Stat	SAT Composite Score	Expected Probability of Graduating	HSGPA	Expected Probability of Graduating
Min	600	23%	0.00	8%
2 SD	1205	40%	2.62	38%
–1 SD	1455	48%	3.12	47%
Average	1705	56%	3.62	57%
+1 SD	1955	64%	4.12	66%
+2 SD	2205	71%	—	—
Max	2400	76%	4.33	69%

Note: Expected probabilities are based on Model 3 for SAT and Model 4 for HSGPA.

Because SAT scores and HSGPA are correlated, it is important to also examine whether each measure uniquely contributes to the prediction of graduation. Moreover, the focus of this study is to examine the added predictive power of SAT scores over HSGPA (Model 5 compared to Model 4) rather than the added predictive power of HSGPA over SAT (Model 5 compared to Model 3). Since HSGPA exists for multiple purposes within the K–12 education system and can be collected from transcripts without additional testing burden to students, it is important to examine the utility of SAT above and beyond HSGPA. As shown in Model 5 of Table 4, both SAT and HSGPA remain positive and significant predictors of college graduation. When comparing Model 4 to Model 5, both the AIC and BIC values decreased — roughly 600 points with the addition of one predictor — and the classification accuracy increased from

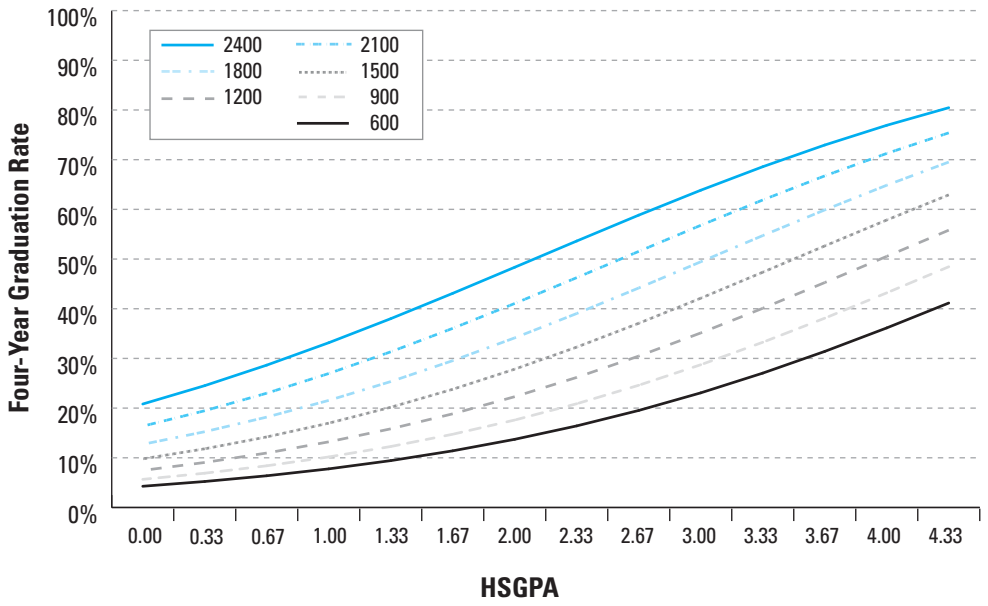
For students with an A+ HSGPA (i.e., 4.33), students with an SAT composite score of 600 are expected to have a 41% probability of graduating in four years, compared to 80% for students with a 2400 SAT composite score.

67.9% to 68.4%, indicating that Model 5 fits the data better and providing evidence that SAT scores provide incremental validity over HSGPA to the prediction of college graduation. Figure 3 visually displays the joint effect of both SAT and HSGPA on graduation, using the estimated model parameters from Model 5. When holding constant HSGPA, the unique effect of SAT becomes visually apparent. For students with an A+ HSGPA (i.e., 4.33), students with an SAT composite score of 600 are expected to have a 41% probability of graduating in four years, compared to 80% for students with a 2400 SAT composite score. Likewise, holding constant SAT performance, it is apparent that HSGPA adds incrementally to the prediction of graduation as well. For example, of students with SAT composite scores of 2400, students with a HSGPA of 0 are expected to have a 21% probability of graduating in four years, compared to 80% of students with a 4.33 HSGPA.

Finally, we examined whether students with a specific SAT score and HSGPA had the same probability of graduating within four years at different types of institutions. Namely, we examined institutional-level (i.e., public, private) and institutional selectivity (i.e., admittance rate) as potential moderating Level 2 variables. As shown in Table 4, Model 6 includes the two institutional-level variables. The parameter estimate for public institutions was negative $\hat{\gamma}_{02} = -1.02, p < .001$, indicating that graduation rates are lower at public institutions than at private institutions for students with the same SAT score and HSGPA. As plotted in Figure 4, the predicted probabilities for public institutions fall below those of the private institutions, holding constant SAT score, HSGPA, and institutional selectivity. For example, students with a 4.00 HSGPA (75th percentile) and an 1880 SAT composite score (75th percentile) attending an institution of average selectivity (i.e., admittance rate = 62.1%) have a 75% probability of graduating in four years at a private institution, compared to 52% probability at a public institution. Moreover, students with a 3.33 HSGPA (25th percentile) attending a private, average selectivity institution have a higher probability of graduating than students with a 4.00 HSGPA (75th percentile) at a public, average selectivity institution across the entire SAT score scale range. Finally, the positive relationship between SAT performance and graduation within institutional control remains, as indicated by the upward sloping regression lines.

Figure 3.

Expected four-year graduation rates by SAT and HSGPA.

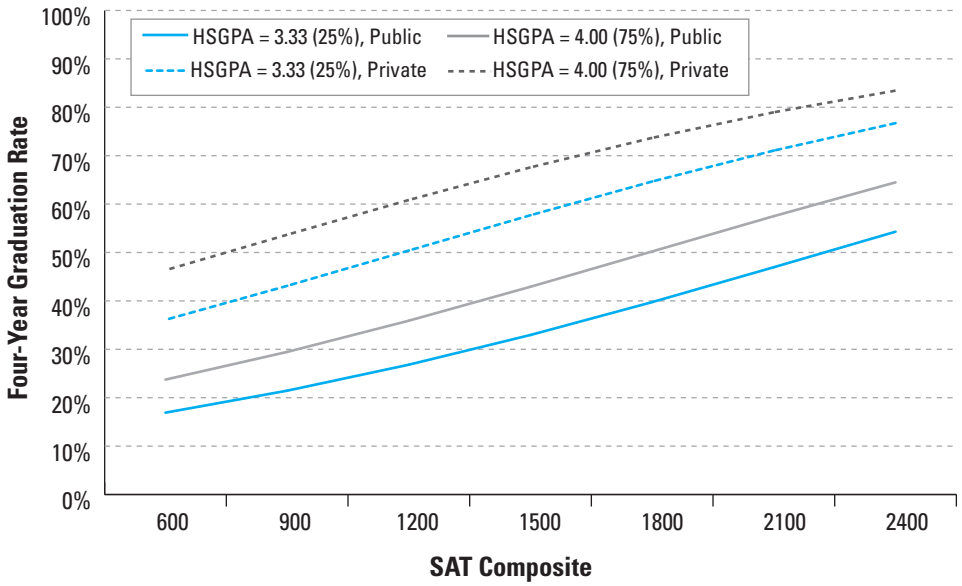


Note: These values are based on parameter estimates from Model 5.

... the results confirm that students with higher SAT scores are more likely to graduate, and graduate in a timely manner (i.e., four years), even after controlling for HSGPA, institutional control, and institutional selectivity.

Figure 4.

Expected four-year graduation rates by SAT, HSGPA, and institutional control.

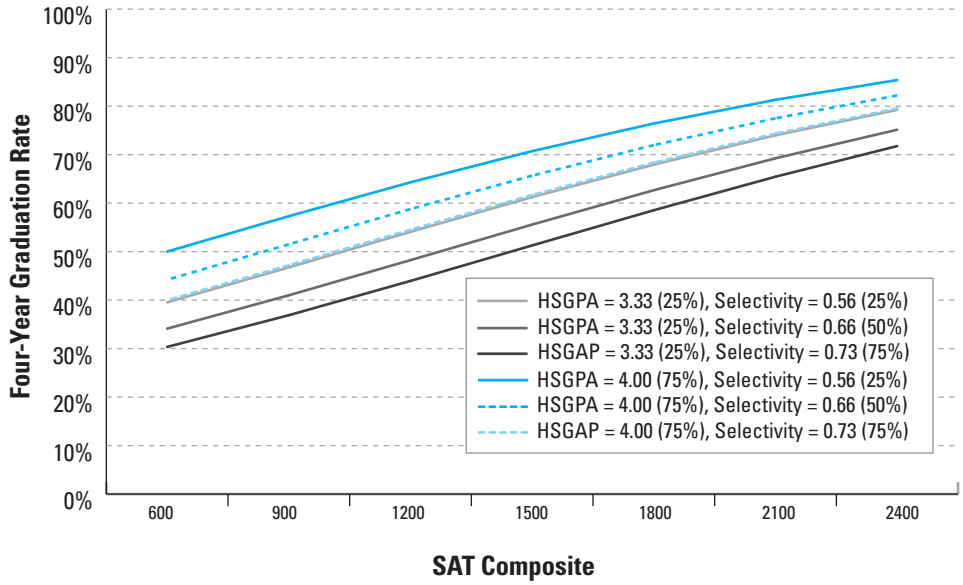


Note: These values are based on parameter estimates for Model 6 with institutional selectivity set to zero to represent institutions of average selectivity (i.e., admittance rate of 62.1%).

Similar to the institutional control results, the parameter estimate for institutional selectivity was negative $(\hat{\gamma}_{01} = -2.35, p < .001)$, indicating that institutions that admit a smaller percentage of students (i.e., are more selective) have higher graduation rates than institutions that admit a larger percentage of students. As plotted in Figure 5, the predicted probabilities for less selective institutions fall below those of more selective institutions, holding constant SAT score, HSGPA, and institutional control. For example, students with a 4.00 HSGPA and an 1880 SAT composite score have a 78% probability of graduating in four years at a private institution that admits 55.8% of their applicants (25th percentile), compared to a 70% probability at a private institution that admits 73.2% of their applicants (75th percentile). Finally, the positive relationship between SAT performance and graduation within institutional selectivity remains, evidenced by the positive trend of the predicted probabilities.

Figure 5.

Expected four-year graduation rates by SAT, HSGPA, and institutional selectivity.



Note: These values are based on parameter estimates for Model 6 with institutional control to zero representing private institutions.

Discussion

The ultimate goal of attending an institution of higher education is to graduate with a college degree. Thus, institutions are interested in selecting applicants that are college ready or best prepared to start college as one way to maximize this goal. The findings from this study provide support for using the SAT as a way to help select such applicants. Namely, the results confirm that students with higher SAT scores are more likely to graduate, and graduate in a timely manner (i.e., four years), even after controlling for HSGPA, institutional control, and institutional selectivity. The results also confirm that HSGPA, institutional control, and institutional selectivity exert unique effects on college graduation rates, though the institutional characteristics play a relatively minor role compared to students' academic predictors.

These findings substantiate the literature on academic performance and college success that has found that students who are academically more prepared are more likely to be successful in college. In particular, research has already demonstrated the strong link between SAT scores and FYGPA (Berry & Sackett, 2009; Bridgeman et al., 2000; Burton & Ramist, 2001; Fishman & Pasanella, 1960; Hezlett et al., 2001; Kobrin et al., 2008; Mattern et al., 2008; Patterson et al., 2009; Patterson & Mattern, 2011; Young, 2001). Likewise, research is accumulating that shows a positive relationship between SAT scores and grades earned in subsequent years as well as college retention (Hezlett et al., 2001; Mattern & Patterson, 2011a, 2011b). Taken together, the research indicates that SAT performance is predictive of college success regardless of how that success is defined.

Congruent with previous research, the results also suggest that both SAT scores and HSGPA provide incremental validity to the prediction of college success (Kobrin et al., 2008). It is true that, overall, students with high SAT scores had a high likelihood of graduating, but it varied greatly when the results were disaggregated by HSGPA. Of students with the highest

possible SAT score, there was roughly a 60-point difference in graduation rates depending on HSGPA (see Figure 3). Likewise, students with a HSGPA equivalent to an A+ had, on average, a high likelihood of graduating in four years, but the results also varied substantially when disaggregated by SAT score, with a 40-point difference between students with the lowest and highest SAT scores (see Figure 3).

Finally, the results for institutional control and selectivity are also in alignment with previous research on the topic (Astin, 1975; Bowen & Bok, 1998; Bowen et al., 2009). Previous research has shown that selective and private institutions tend to have higher graduation rates. This is true even after controlling for the academic preparedness of their student bodies. However, the question remains: Why do these types of institutions have better success at graduating their student bodies? It has been suggested that this could be due to peer effects and the role of norms or expectations (Bowen et al., 2009). Specifically, students may be more likely to graduate if their peers are also graduating or if the institution has created a culture that has high graduation expectations.

As with any research, there are a few limitations to this study worth mentioning. First, HSGPA was based on self-reported data. As such, we acknowledge that the self-reported HSGPA may not have been accurate for some students. A recent meta-analysis found that in general, students do accurately report their HSGPAs (Kuncel, Credé, & Thomas, 2005). Specifically, the correlation between self-reported HSGPA and actual HSGPA was .82. Additionally, Shaw and Mattern (2009) examined the validity of self-reported HSGPA, both in terms of the correlation between self-reported and school-reported HSGPA as well as in terms of the means, standard deviations, and match rates. These additional analyses help supplement correlational results since self- and school-reported HSGPAs can correlate perfectly, even if all students inflate their HSGPAs by one point. Based on 40,301 students across 32 institutions, Shaw and Mattern (2009) found that the mean school-reported HSGPA (M = 3.58, SD = 0.43) was nearly identical to the mean self-reported HSGPA (M = 3.54, SD = 0.45). In terms of match rates, 52% of students reported an HSGPA that precisely matched their school-reported HSGPA. The percentage of students with a self-reported HSGPA that was within one full grade (e.g., range of B- through B+) of the school-reported HSGPA was 89%. These findings alleviate some of the concerns associated with using self-reported high school grades.

Another potential limitation of the study is the fact that we examined four-year graduation rates, whereas more recently the dialogue has shifted to six-year graduation rates. There is, however, an economic rationale for considering four-year graduation rates. In the 2010-11 academic year, student loans per full-time equivalent (FTE) student averaged $4,907 (College Board, 2011). Given that student debt generally accumulates as students persist in college, graduation in four years is preferable to graduation in six years both in terms of lessening student debt and reducing government expenditures on loans. Thus, we believe that it is important to examine which students graduate in the traditional time frame of four years, but we also think that both time frames (four and six years) are useful and should be evaluated. To that end, we are collecting additional data on this cohort of students and will be able to examine six-year graduation rates in the future. It will be interesting to see the extent to which SAT scores remain a significant predictor of graduation when a longer time frame is allotted for completion. In a similar vein, rather than dichotomizing graduation, research should examine "time to graduation" as a continuous variable and utilize survival analysis to model when a student will graduate.

It should also be noted that students could not be tracked across institutions, so we had to infer a failure to graduate within four years for those students who did depart from their original institutions. Since students may well have graduated from another institution, even within four years, there may be some false negatives in the sample.

In sum, this study builds on the existing literature of the usefulness of SAT scores for use in college admission. In particular, the results from this study reveal that SAT performance is predictive not only of short-term college outcomes such as FYGPA but also of college graduation. By using both SAT scores and HSGPA, institutions can select applicants with the highest likelihood of success.

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