The Validity of the SAT for Predicting Cumulative Grade Point Average by College Major

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Purpose of Research

- Examine differential validity and prediction of the SAT and HSGPA for predicting cGPA, by major field.
- First study of the predictive validity of the revised SAT (includes writing) by college major.
- Analyze results by gender, race/ethnicity, and highest parental education level within major.
- Incorporates more specialized college major fields than most previous studies which typically examine the predictive validity within broader academic domains.

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Prior Research

- Students choose an academic major for a variety of reasons (e.g. Pascarella & Terenzini, 2005).
- Major fields have their own unique characteristics - different grading standards, more clearly delineated paradigms than others.
- Morgan (1990): predictive validity of the SAT by major – SAT Math regression weights were higher than SAT Verbal weights in the prediction of FYGPA for technical majors while opposite was true for liberal arts majors.
- Pennock-Román (1994) : while female students' college grades are typically under-predicted by the SAT, controlling for grading leniency by major did reduce the differential prediction of GPA by gender, though it did not completely eradicate the differential prediction.

Method

Sample

- Of 66 four-year institutions from the national SAT Validity Study sample (see Kobrin et al., 2008) supplying 2nd year data on the entering class of fall 2006, 39 institutions supplied major field information.
- In order for students at these 39 institutions to be included in the sample for this study, they had to have:
  - taken the SAT;
  - indicated their high school GPA (HSGPA) on the SAT-Q;
  - a valid first-year college GPA;
  - a valid two-year cumulative college GPA (cGPA); and
  - a valid major provided by the college or university.
- Ultimately, there were 39,440 students included in this study.

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Method (cont.)

Data

- **Demographic information.** Gender, ethnicity, and highest parental education level was self-reported by the students and obtained from the SAT-Questionnaire (SAT-Q).
- **SAT scores**. Obtained from the 2006 College-Bound Seniors cohort database comprised of students who participated in the SAT program and reported plans to graduate from high school in 2006.
- **HSGPA.** *S*elf-reported and obtained from the SAT-Q. Students' HSGPAs were on a 12-point scale ranging from A+ (4.33) to F (0.00). (M = 3.65;SD = 0.50).
- **Cumulative Second-Year GPA (cGPA).** Each participating institution provided cum 2nd-year GPA for their 2006 first-time, first-year students. (*min* = 0.00, *max* = 4.17; M = 3.10, SD = 0.59).
- **College Majors.** Reported by the institutions at beginning of 3rd year, and based on Classification of Instructional Program (CIP) codes or combinations of CIP codes. Students with no academic major at the time of the study were considered to have *undeclared* majors.
- **Retention to the 3rd year.** Each participating institution supplied third-year retention data for their 2006 first-time, first-year students. (1 = Returned for 3rd Yr, 0 = Did not Return; M = 0.91, SD = 0.29).

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Method (cont.)

Analyses

The **differential validity** of the SAT and HSGPA to predict cGPA by major was examined by computing correlations and multiple correlations.

- Computed at the institutional level (by major, or by major and subgroup), then pooled across institutions, and weighted by sample size.
- Corrected for restriction of range with the Pearson-Lawley multivariate correction with 2006 College Bound Seniors cohort as population (Gulliksen,1950).

To assess the extent to which the SAT, as well as HSGPA, exhibits **differential prediction** of cGPA, regression equations within each institution were estimated.

- Next, the average residual was computed across the entire sample, separately for each major and major by subgroup. The expected value of the residual for the total group always equals zero; however:
  - If the average residual value is positive for a specific subgroup, then the measure tends to under-predict academic success for that group.
  - If the average residual value is negative, then the measure tends to over-predict academic success for that group

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Descriptive Statistics

Major Category	k	n	%	SAT-CR Mean	SAT-CR SD	SAT-M Mean	SAT-M SD	SAT-W Mean	SAT-W SD	HSGPA Mean	HSGPA SD	cGPA Mean	cGPA SD	Retention to Year 3 Mean	Retention to Year 3 SD
Agriculture/Natural Resources	24	514	1%	564	82.6	570	77.1	548	80.7	3.61	0.51	3.03	0.57	0.93	0.26
Biological and Biomedical Sciences	39	3,329	8%	582	91.4	608	90.6	575	92.0	3.80	0.45	3.17	0.58	0.91	0.28
Business, Management, and Marketing	36	6,259	16%	541	88.8	577	91.3	537	88.8	3.58	0.52	3.07	0.59	0.91	0.28
Communications/Journalism	35	2,616	7%	553	89.0	548	89.0	551	86.6	3.58	0.51	3.10	0.54	0.94	0.25
Computer and Information Science	37	901	2%	588	94.6	633	87.4	566	94.0	3.62	0.48	2.95	0.64	0.90	0.30
Education	27	2,126	5%	521	85.5	531	86.8	519	84.6	3.55	0.50	3.15	0.57	0.89	0.31
Engineering/Architecture	31	5,509	14%	593	84.4	657	76.1	579	85.1	3.80	0.43	3.08	0.59	0.95	0.22
Foreign Languages, Literatures, & Linguistics	30	603	2%	606	96.4	592	90.6	601	97.5	3.76	0.46	3.30	0.54	0.94	0.24
Health Professions & Related Clinical Sciences	30	2,417	6%	535	84.2	557	85.4	537	81.4	3.70	0.46	3.16	0.54	0.89	0.31
Humanities and Liberal Arts	39	5,236	13%	587	93.8	568	88.9	575	90.7	3.61	0.49	3.19	0.55	0.92	0.28
Mathematics and Statistics/Physical Sciences	35	1,310	3%	591	95.1	639	89.7	577	93.5	3.78	0.45	3.14	0.60	0.93	0.25
Security and Protective Services	18	623	2%	501	80.1	515	83.8	494	81.9	3.29	0.50	2.86	0.63	0.87	0.33
Social Sciences	39	5,527	14%	584	96.0	580	96.6	575	94.6	3.65	0.48	3.14	0.55	0.93	0.26
Social Services and Public Administration	20	271	1%	532	88.1	517	92.4	520	89.8	3.51	0.50	3.03	0.59	0.90	0.29
Undeclared	30	2,199	6%	540	100.6	557	103.3	533	99.3	3.46	0.54	2.72	0.65	0.70	0.46
Total	39	39,440	100%	566	94.3	585	96.9	558	92.4	3.65	0.50	3.10	0.59	0.91	0.29

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Differential Validity

Restriction-of-Range Corrected Correlations with 2nd-Year Cumulative GPA by Major

Major Category	k	n	SAT-CR	SAT-M	SAT-W	SAT*	HSGPA	SAT*, HSGPA
Agriculture/Natural Resources	11	474	0.56	0.56	0.57	0.61	0.58	0.68
Biological and Biomedical Sciences	37	3,317	0.55	0.59	0.58	0.63	0.58	0.70
Business, Management, and Marketing	35	6,253	0.51	0.53	0.54	0.58	0.57	0.66
Communications/Journalism	30	2,593	0.52	0.51	0.54	0.57	0.57	0.65
Computer and Information Science	15	808	0.43	0.46	0.47	0.50	0.52	0.58
Education	23	2,109	0.53	0.50	0.58	0.59	0.56	0.66
Engineering/Architecture	22	5,474	0.52	0.57	0.55	0.61	0.60	0.69
Foreign Languages, Literatures, and Linguistics	16	544	0.51	0.46	0.56	0.57	0.48	0.61
Health Professions and Related Clinical Sciences	24	2,393	0.54	0.55	0.59	0.62	0.58	0.68
Humanities and Liberal Arts	38	5,234	0.50	0.49	0.54	0.56	0.58	0.65
Mathematics and Statistics/Physical Sciences	29	1,269	0.55	0.59	0.56	0.63	0.61	0.71
Security and Protective Services	16	608	0.55	0.52	0.54	0.58	0.59	0.68
Social Sciences	37	5,518	0.52	0.51	0.55	0.58	0.56	0.65
Social Services and Public Administration	11	234	0.55	0.45	0.51	0.56	0.52	0.63
Undeclared	24	2,159	0.37	0.34	0.41	0.42	0.44	0.49
Total	39	39,440	0.51	0.50	0.55	0.57	0.57	0.66

Note. SAT* indicates that each of the three SAT sections were included as separate predictors in the computation of the multiple correlation.

Differential Prediction

Differential Prediction Analyses with 2nd-Year Cumulative GPA by Major

Major Category	k	n	SAT-CR	SAT-M	SAT-W	SAT*	HSGPA	SAT*, HSGPA
Agriculture/Natural Resources	24	514	-0.08	-0.05	-0.06	-0.07	-0.05	-0.07
Biological and Biomedical Sciences	39	3,329	0.02	0.01	0.01	0.00	-0.02	-0.03
Business, Management, and Marketing	36	6,259	0.03	0.00	0.03	0.03	0.02	0.04
Communications/Journalism	35	2,616	0.02	0.07	0.01	0.04	0.04	0.05
Computer and Information Science	37	901	-0.12	-0.15	-0.11	-0.13	-0.07	-0.10
Education	27	2,126	0.17	0.17	0.16	0.17	0.11	0.15
Engineering/Architecture	31	5,509	-0.04	-0.10	-0.03	-0.07	-0.05	-0.08
Foreign Languages, Literatures, & Linguistics	30	603	0.09	0.15	0.08	0.09	0.12	0.08
Health Professions and Related Clinical Sciences	30	2,417	0.11	0.10	0.09	0.11	0.03	0.08
Humanities and Liberal Arts	39	5,236	0.04	0.11	0.04	0.05	0.10	0.06
Mathematics & Statistics/Physical Sciences	35	1,310	-0.01	-0.07	0.00	-0.04	-0.03	-0.06
Security and Protective Services	18	623	-0.09	-0.10	-0.08	-0.07	-0.07	-0.04
Social Sciences	39	5,527	-0.01	0.03	-0.01	0.00	0.01	0.01
Social Services & Public Administration	20	271	0.03	0.08	0.04	0.07	0.03	0.08
Undeclared	30	2,199	-0.34	-0.34	-0.33	-0.31	-0.30	-0.27
Total	39	39,440	0.00	0.00	0.00	0.00	0.00	0.00

Note. SAT* indicates that each of the three SAT sections were included as separate predictors in the computation of the multiple correlation.

Discussion

- The relationship between SAT and HSGPA and cGPA varies by major field.
- With the exception of a few major fields, the corrected multiple correlations between the SAT (Critical Reading, Math, and Writing) and cGPA were in the high 0.50s or low 0.60s, representing a strong relationship.
- The starkest differences in the relationship between both SAT and HSGPA with cGPA across majors was found among undeclared students versus students in defined major fields (weaker correlations and greatest over-prediction).
- The strongest correlations tended to be found in the STEM fields, with the exception of Computer Science students who tended to perform differently in high school and college than students in other STEM majors.

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Discussion (continued)

- The SAT also slightly over-predicted cGPA in the STEM majors, likely because these majors are considered to be more academically difficult or have more stringent grading practices; and therefore, students earn lower cGPAs than they would have in other academic fields (Biglan, 1973; Goldman & Hudson, 1973).
- There was under-prediction of cGPA by the SAT in a few other majors, most notably for Education majors. This under-prediction is also likely related to the less stringent grading practices in these fields (Willingham, Lewis, Morgan, & Ramist, 1990).

Future Research

- Replicate these analyses with a different or broader sample of institutions and students to determine the reliability and generalizability of results.
- Examine differential validity and prediction by major at graduation to determine whether there are any differences in findings when more advanced coursework by major is factored into cGPA.
- Examine the relationship between the SAT and college outcomes by major by the institution-types/characteristics (e.g., whether it is a STEM-focused or more of a liberal arts institution).
- Study the academic trajectories of undeclared students and work on minimizing academic difficulties and focusing on major choice and fit for these students.
- Examine the academic and social cultures within the different majors that serve as supports or barriers for different enrolled student groups.

Thank You

- Researchers are encouraged to freely express their professional judgment. Therefore, points of view or opinions stated in College Board presentations do not necessarily represent official College Board position or policy.
- Please forward any questions, comments, and suggestions to:
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Presentation References

Biglan, A. (1973). The characteristics of subject matter in different academic areas. *Journal of Applied Psychology, 57,* 195-203

Goldman, R.D., & Hudson, D.J. (1973). A multivariate analysis of academic abilities and strategies for successful and unsuccessful college students in different major fields. *Journal of Educational Psychology, 65,* 364-370.

Gulliksen, H. (1950). *Theory of mental tests.* New York: John Wiley and Sons.

Kobrin, J. L., Patterson, B. F., Shaw, E. J., Mattern, K. D., & Barbuti, S. M. (2008). *Validity of the SAT® for predicting first-year college grade point average* (College Board Research Rep. No. 2008-5). New York, NY: The College Board.

Mattern, K. D., Patterson, B. F., Shaw, E. J., Kobrin, J. L., & Barbuti, S. M. (2008). *Differential validity and prediction of the SAT®* (College Board Research Rep. No. 2008-4). New York, NY: The College Board.

Morgan, R. (1990). Analyses of predictive validity within student categorizations. In W. Willingham, C. Lewis, R. Morgan, & L. Ramist, (Eds.), *Predicting College Grades: An Analysis of Institutional Trends over Two Decades* (pp. 225-238). Princeton, NJ: Educational Testing Service.

Pascarella, E. & Terenzini, P. (2005). *How college affects students (Vol. II): A third decade of research*. San Francisco: Jossey-Bass.

Pennock-Román, M. (1994). *College major and gender differences in the prediction of college grades* (College Board Research Report No. 94-2, ETS RR-94-24). New York:The College Board.

Willingham, W., Lewis, C., Morgan, R., and Ramist, L. (1990). *Predicting college grades: An analysis of institutional trends over two decades*. New York: The College Board and Educational Testing Service.