# Exploring the Variability in the Validity of SAT Scores and High School GPA for Predicting First-Year College Grades at Different Colleges and Universities

Jennifer L. Kobrin & Brian F. Patterson

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# Background

- The SAT is one of the most researched tests, with hundreds of published validity studies.

- Vast majority of studies including samples at multiple institutions examine the relationship of SAT scores and HSGPA with college performance in aggregate.

- Studies show that the relationship of SAT scores and HSGPA with FYGPA varies at different institutions/different types of institutions.

# Prior Research Exploring Variations in SAT Predictive Validity

- Baird (1983) used college characteristics as predictor variables to predict the size of the simple and multiple correlations of SAT and HSGPA with FYGPA (validity coefficients).

- A few studies have examined the validity of the SAT using a multilevel view:

    - Brown and Zwick (2006) – Validity of SAT and SAT Subject Tests for predicting FYGPA at Univ. of CA.

    - Culpepper and Davenport (2009) – Variability in differential prediction of FYGPA using SAT and HSGPA by racial/ethnic group.

    - Shen et al. (2010) – created factors of institutional characteristics and used these to predict variability in SAT validity after taking account of statistical artifacts.

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# Purpose of the Current Study

To demonstrate the utility of a multilevel model to understand the relationship of institutional characteristics to the validity of the SAT and HSGPA for predicting first-year college GPA (FYGPA).

# Method

- Sample consisted of about 150,000 students from 109 colleges and universities across the U.S.

- SAT scores obtained from 2006 college-bound seniors cohort; HSGPA self-reported on SAT Questionnaire.

- First phase replicated Baird (1983) to identify variables to use in the multilevel modeling.

  *(Results from this phase will not be presented today)*

- Second phase used Hierarchical Linear Modeling (HLM) to model the variability in the relationship of SAT scores and HSGPA with FYGPA across the 109 institutions.

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# HLM Specifics

- Analyses followed a step-wise approach, beginning with null model (one-way random effects ANOVA)

- Full maximum likelihood estimation used in all models.

- Random effects included for all student-level predictors.

- Student-level predictors (SAT, HSGPA) were centered within institution (group-mean centered) and institution-level predictors were grand-mean centered.

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# Model-Building Summary

- Model 1 – Null Model (ICC = 0.109)

- Model 2 – added student-level predictors (SAT/1000 and HSGPA)

- Model 3 – added average SAT/1000 and average HSGPA as Level 2 predictors.

- Models 4 and 5 – added Level 2 predictors one at a time according to approximate coefficients and t-values estimated by the HLM program.

# Final Model

**Level 1**:

$$FYGPA_{ij} = \beta_{0j} + \beta_{1j}*(HSGPA)_{ij} + \beta_{2j}*(SAT\ total/1000)_{ij} + r_{ij}.$$

**Level 2:**

$$\beta_{0j} = \gamma_{00} + \gamma_{01}(average\ SAT)_j + \gamma_{02}\ (average\ HSGPA)_j + \gamma_{03}\ (private)_j + \gamma_{04}(\ small)_j + \gamma_{05}\ (large)_j + \gamma_{06}\ (very\ large)_j + \mu_{0j}$$

$$\beta_{1j} = \gamma_{10} + \gamma_{11}(average\ SAT)_j + \gamma_{12}\ (average\ HSGPA)_j + \gamma_{13}\ (average\ financial\ aid) + \gamma_{14}\ (\%\ white) + \mu_{1j}$$

$$\beta_{2j} = \gamma_{20} + \gamma_{21}(average\ SAT)_j + \gamma_{22}\ (average\ HSGPA)_j + \gamma_{23}\ (\%\ submitting\ SAT)_j + \gamma_{24}\ (small)_j + \gamma_{25}\ (large)_j + \gamma_{26}\ (very\ large)_j + \mu_{2j.}$$

# Results:  Final Estimation of Fixed Effects for Intercept (Average FYGPA)

| Variable | Coefficient | Robust S.E. |
|---|---|---|
| *Intercept* | **2.963** | 0.036 |
| Average SAT/1000 | **0.912** | 0.151 |
| Average HSGPA | 0.027 | 0.129 |
| Private Institution | **0.105** | 0.039 |
| Small Institution | **-0.073** | 0.041 |
| Large Institution | -0.009 | 0.030 |
| Very large institution | -0.031 | 0.045 |

# Results: Final Estimation of Fixed Effects for HSGPA Slope (Predictive Validity of HSGPA)

| Variable | Coefficient | Robust S.E. |
|---|---|---|
| *HSGPA slope* | **0.419** | 0.008 |
| Average SAT/1000 | **-0.298** | 0.129 |
| Average HSGPA | 0.053 | 0.091 |
| Average Financial Aid | **-0.000** | 0.000 |
| Percent of White first-year students | **0.002** | 0.000 |

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# Results:  Final Estimation of Fixed Effects for SAT Slope (Predictive Validity of SAT)

| Variable | Coefficient | Robust S.E. |
|---|---:|---:|
| *SAT slope* | **0.813** | 0.032 |
| Average SAT/1000 | **-1.190** | 0.234 |
| Average HSGPA | **0.991** | 0.183 |
| Percent submitting SAT | **0.005** | 0.001 |
| Small institution | **0.177** | 0.066 |
| Large institution | -0.032 | 0.046 |
| Very large institution | -0.058 | 0.055 |

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# Results:  Final Estimation of Variance Components

| Random Effect | Variance Component | df | Chi-square | p |
|---|---|---|---|---|
| Intercept | **0.016** | 86 | 6459.03 | < .001 |
| HSGPA slope | **0.005** | 88 | 484.08 | < .001 |
| SAT slope | **0.023** | 86 | 463.65 | < .001 |
| Student-Level | **0.358** | | | |

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# Summary of Findings

**Predictive validity of HSGPA (once SAT scores are considered):**

- Stronger at institutions with higher percentage of white freshmen.

- Not as strong at institutions with higher mean SAT and at institutions with higher average financial aid package.

**Predictive validity of SAT (once HSGPA is considered):**

- Stronger at institutions with higher mean HSGPA, at institutions with higher percentage submitting SAT scores, and at smaller institutions.

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# Study Limitations

- Student-level model included only HSGPA and SAT scores; future research may include student demographic variables (gender, ethnicity, SES).

- Scores on the 3 SAT sections were combined.

- The criterion variable (FYGPA) may not be completely comparable across institutions.

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- Please forward any questions, comments, and suggestions to:

  Jennifer Kobrin at: jkobrin@collegeboard.org

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