The Jim Self Center on the Future

Subject: **C**omparison of Actual and Predicted Scholastic Aptitude Test (SAT) Scores Accounting for the Effects of Racial Composition, Poverty, Class Size, and Teacher Characteristics

Tables: **T**he **top thirty** and **bottom thirty** schools in South Carolina performing higher / lower than expected on the SAT during the 1998-99 academic year. **Tables of performance for all high schools in South Carolina**.

Standardized test scores are now relied upon as benchmarks of school performance, and may become even more heavily relied upon as performance indicators if many of the Bush Administration's education initiatives move forward and if South Carolina enforces its "meet the standards or repeat the grade" policy. While over-reliance on standardized test scores ignores the tremendous complexity of the learning process, and evaluation of only raw scores overlooks the numerous contextual factors that influence academic performance, these performance indicators can and should be used to assess how well our schools are contributing to student development. It would be useful to know more about the relationship between demographic and class size factors, teacher influences, and test performance. It would also be useful to be able to identify which schools are able to excite performance beyond what would be expected given the combined effects of compromising factors, as well as which schools fail to fully capitalize on their favorable circumstances.

Recently, the Jim Self Center on the Future was asked by the Office of Access and Equity at Clemson University to offer some means of ranking high school performance on the SAT while accounting for the combined effects of racial composition and poverty conditions. The purpose of their inquiry was to better enable them to identify South Carolina high schools that appear most successful in stimulating high-level performance from students in challenged environments. The Center performed these and additional analyses to better understand how a variety of factors are related to SAT performance, and developed several predictive models for comparing expected and actual average SAT scores for each high school in South Carolina. Data for these analyses were drawn from the South Carolina Department of Education 1998-99 Performance Profiles, available at **http://www.sde.state.sc.us/sde/distschs/dsindex.htm**.

Using the 1998-99 Performance Profiles, the Center on the Future assessed several models to identify the one most effective for predicting SAT scores in South Carolina high schools. From our analyses, a model comprised of the following nine variables emerged as most predictive:

Variable:	Correlation Coefficient:	Significance Level *:
1. Percentage of Students in Free or Reduced Lunch Program (pctfree)	- 0.171	0.009
2. Percentage of Students African American (pctblack)	- 0.762	0.000
3. Percentage of Students Other Races (pctother)	0.432	0.000
4. Average Daily Membership Grade 12 (ADM12)	0.495	0.000
5. Percentage of Seniors Completed SAT (pctsrsat)	0.494	0.000
6. Percentage of Teachers with Masters Degree (pctmast)	0.250	0.000
7. Percentage of Teachers with Six Year Certificate or Doctorate	0.288	0.000
8. Average Teachers' Years of Experience	0.147	0.022
9. Average Teachers' Salary	0.492	0.000

* One-Tailed Significance

Combined, these nine variables account for approximately 71% of the variation in SAT scores in South Carolina high schools (Multiple $r^2 = 0.713$). To evaluate SAT performance in South Carolina high schools while accounting for the effects of racial composition, poverty, class size, and teacher effects, we used the following model:

SAT = f(% Students on Free or Reduced Lunch, % African American Students, % "Other" Students, ADM Grade 12, % Seniors Completed SAT, % Teachers with Masters Degree, % Teachers with Six Year Certificate or Doctorate, Average Teacher Experience, Average Teacher Salary)

Analysis using SAT scores as the dependent variable and these nine independent variables produced the following regression equation:

$$Y_{sat} = 761.54 + 0.0061\,(pctfree) - 1.73\,(pctblack) + 6.32\,(pctother) + 0.12\,(adm12) + 0.89\,(pctsrsat) + 0.38\,(pctmast) + 0.22\,(pctsydoc) - 1.90\,(avgexp) + 4.73\,(avgsal)$$

F = 49.20 Significance = 0.000
Multiple $r^2 = 0.713$
Standard Error = 46.50

Use of this model allows us to compare their predicted average SAT score to their actual average SAT score in a manner that accounts for racial composition, poverty, class size effects, and teacher effects. We subtract a school's predicted SAT score from their actual SAT score, generating a "difference" score. These "difference" values are standardized for comparative purposes, and offer insights into which high schools perform better or worse than expected on the SAT while accounting for the effects of the independent variables.

We ranked the state's 193 high schools by their difference in predicted and actual average SAT performance, and the following tables present the top- and bottom-thirty performing schools. For example, Mt. Pleasant High School has an average SAT score of 878, but their predicted average SAT score is 783.46, a difference of +94.54 that is significant at the 0.05 level. This suggests that, despite the anticipated influences of a number of factors, Mt. Pleasant High School was able to get their students to perform well on the SAT relative to other schools facing similar circumstances.

Independent samples T-Tests show that the differences between the top thirty and bottom thirty schools, measured by differences in actual and predicted SAT scores, are not explained by significant differences in any of the independent variables:

1. Variable: Percentage of Students Enrolled in Free or Reduced Lunch Program
   Mean: Top Thirty Schools—44.32%
   Mean: Bottom Thirty Schools—44.46%
   T_{calc}: -0.27
   Significance: 0.98
   Conclusion: No significant difference between the top thirty and bottom thirty schools in percentage of students enrolled in free or reduced lunch programs

2. Variable: Percentage of Students, African American
   Mean: Top Thirty Schools—52.70%
   Mean: Bottom Thirty Schools—50.03%
   T_{calc}: 0.36
   Significance: 0.72
   Conclusion: No significant difference between the top thirty and bottom thirty schools in percentage of African American students

3. Variable: Percentage of Students, "Other" Races
   Mean: Top Thirty Schools—1.43%
   Mean: Bottom Thirty Schools—1.37%
   T_{calc}: 0.12
   Significance: 0.91
   Conclusion: No significant difference between the top thirty and bottom thirty schools in percentage of "Other" Races students

4. Variable: Average Daily Membership, Grade 12
Mean: Top Thirty Schools—141.90
Mean: Bottom Thirty Schools—130.63
T_{calc}: 0.46
Significance: 0.65
Conclusion: No significant difference between the top thirty and bottom thirty schools in Average Daily Membership, Grade 12

5. Variable: Percentage of Seniors Completing SAT
Mean: Top Thirty Schools—47.33%
Mean: Bottom Thirty Schools—52.37%
T_{calc}: -1.40
Significance: 0.17
Conclusion: No significant difference between the top thirty and bottom thirty schools in percentage of seniors completing SAT

6. Variable: Percentage of Teachers with Masters Degree
Mean: Top Thirty Schools—33.18%
Mean: Bottom Thirty Schools—34.74%
T_{calc}: -0.75
Significance: 0.46
Conclusion: No significant difference between the top thirty and bottom thirty schools in percentage of teachers with Masters Degrees

7. Variable: Percentage of Teachers with Six Year Certificate or Doctorate
Mean: Top Thirty Schools—23.84%
Mean: Bottom Thirty Schools—24.72%
T_{calc}: -0.46
Significance: 0.65
Conclusion: No significant difference between the top thirty and bottom thirty schools in percentage of teachers with Six Year Certificate or Doctorate

8. Variable: Average Teacher Experience (years)
Mean: Top Thirty Schools—13.60
Mean: Bottom Thirty Schools—13.96
T_{calc}: -0.62
Significance: 0.54
Conclusion: No significant difference between the top thirty and bottom thirty schools in Years of Teacher Experience

9. Variable: Average Teacher Salary (thousands)
Mean: Top Thirty Schools—34.27
Mean: Bottom Thirty Schools—34.47
T_{calc}: -0.35
Significance: 0.73
Conclusion: No significant difference between the top thirty and bottom thirty schools in Average Teacher Salary

The lack of any significant differences between the top and bottom thirty schools on any of the independent variables supports the contention that the differences in actual and predicted SAT performance is likely explained by influences arising within the schools. Essentially, it appears that some schools are able to "add value" to the students that come through their doors—the top thirty schools are able to work very well with the students and the contexts in which they operate to elicit higher than expected SAT performance. Likewise, it appears that the bottom thirty schools do not fully capitalize on their circumstances by generating SAT performance at expected levels.

Upon reviewing this information, it is important to bear in mind that "correlation" and regression modeling do not, in any manner, suggest causation. For example, while the percentage of African American students in a high school has a significant negative correlation with average SAT scores, this does not mean that having a high percentage of African American students "causes" lower SAT scores. Rather, this should be interpreted as meaning that the relationship between these two variables, as observed in this set of data, is such that schools with higher African American enrollment tend to show a pattern of lower average SAT scores—the "causes" for this pattern are subject to a number of possible explanations that fall beyond the scope of this report. Several variables, including race- and poverty-oriented measurements, are likely influenced by a number of latent variables that would require additional field research and analyses to adequately comprehend.

We think it wise, in the absence of perfect testing approaches, to more fully account for extraneous characteristics when assessing performance using standardized test scores. Comparisons of actual and expected test performance at school levels, using the approach described above, accomplishes this, and better enables evaluators to identify which schools are enhancing the performance of their students within the contexts in which they function. We see potential to apply this approach not only to assessing SAT performance, but PACT series performance as well. We also regard relative performance measurements as a more valid basis for performance incentive awards, such as the Governor's financial incentive awards for SAT improvements. This research suggests that school-level influences may greatly impact student academic performance, and we recommend field studies to identify those practices that either advance or inhibit student performance relative to expected performance levels. Likewise, additional work is needed to identify possible latent variables associated with racial composition and poverty and more fully comprehend their effects on academic performance.

*The tables are available as pdf files in tabloid size (11x17 inches) for viewing on-screen and for printing. To print on 8 1/2 x 11 inch paper use **table1-1** and **table2-2**.

Table 1. Top Thirty South Carolina High Schools Performing Higher than Expected on the Scholastic Aptitude Test (SAT) in 1998-99 Academic Year

Table 2. Bottom Thirty South Carolina High Schools Performing Lower than Expected on the Scholastic Aptitude Test (SAT) in 1998-99 Academic Year

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