

The Relationship of Performance on the Dental Admission Test and Performance on Part I of the National Board Dental Examinations

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Abstract: Although many schools use scores on the Dental Admission Test (DAT) to evaluate applicants, the association of these scores with students' performance on Part I of the National Board Dental Examinations (NBDE) has not been recently evaluated. In this study, the hypothesis that the DAT scores would be a significant predictor of Part I of the NBDE scores was tested. We analyzed by multiple regression the scores on both examinations for the 114 students matriculating in the University of Mississippi School of Dentistry in 1992, 1993, 1994, and 1995. The results indicate that DAT reading comprehension was a statistically significant predictor (p value less than or equal to 0.05) of all four subtests of Part I of the NBDE. The DAT biology and organic chemistry scores were statistically significant predictors of NBDE biochemistry-physiology, and the DAT quantitative analysis score was a statistically significant predictor of NBDE dental anatomy and occlusion. DAT perceptual ability and general chemistry were not significant predictors.

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Each year in the United States, there are many more applicants for admission to schools of dentistry than there are available positions in first-year dental school classes. The ratio of applications received to positions available increased from 8:1 in 1992-93 to 15:1 in 2000-01.^{1,2}

According to the American Dental Association,¹ 100 percent of U.S. dental schools review the applicant's undergraduate science grade point average, the general undergraduate grade point average, and scores on at least one portion of the Dental Admission Test (DAT) as factors for admission. Further, 98 percent of dental schools review recommendations, 93 percent interview applicants, and 78 percent consider the undergraduate non-science grade point average as separate factors.¹

Although the DAT is administered to prospective dental students as only one criterion assessed for enrollment and scores achieved on it are only one of the measures evaluated, the DAT is the only national standardized test that can be used to compare students throughout the country seeking admission to schools of dentistry.

According to the American Dental Association's Department of Testing,³ when the Dental Admission Testing Program was implemented in 1945, one of the stated reasons for its implementation was that grades from various undergraduate educational institutions did not necessarily represent the same degree of educational achievement. The DAT was developed to provide a means of comparing prospective students by the use of a national test commonly administered to all applicants.

After students have matriculated in schools of dentistry, the only other national tests they must complete are the National Board Dental Examinations (NBDE) Part I and Part II, which were first administered in the 1930s. Part I and Part II of the NBDE are the only national testing experiences for enrolled students, and passing them is required for dental students to be licensed to practice dentistry in the United States. Additionally, scores achieved on Part I are used as one criterion for acceptance to postdoctoral specialty residencies.

To educate effectively, dental educators must be able to predict which students will do well in the dental curriculum. There have been few studies of either the DAT or the NBDE Part I since the 1970s. The earlier studies, which used student grades in dental school courses as the measure of success, were inconclusive concerning the value of the DAT as a predictor of dental school grades. In the present study, we tested the hypothesis that the DAT subtest scores are significant predictors of Part I NBDE scores.

Understanding the relationship between the two examinations is crucial because both test knowledge considered fundamental to performance as a dentist: the DAT examines fundamental knowledge necessary to thrive in the dental school environment, and Part I of the NBDE tests critical knowledge in the basic sciences. There has been no recently published study pertaining to the predictive value of the individual subtests of the DAT. In addition, no studies have been published since the 1980s examining the correlation of student scores on the DAT subtests and NBDE Part I scores.

Literature Review

There have been no recently published studies concerning the predictive value of the subtests of the DAT in relation to the NBDE Part I. However, in 1958 Webb⁴ evaluated the DAT as a predictor of dental school grades. Webb conducted this study because there was concern among dental school faculties about the effectiveness of the DAT as a predictor of dental school performance as evidenced by grade point averages attained in dental school. When Webb used a simple correlation coefficient and scatter grams to express the relationships, he found that predictor relationships were not universal across all dental schools. Webb theorized that since the DAT given to candidates was the same for all schools, the differences in correlation coefficients were the result of differences among them.

When Webb also found that the poorest predictors for one school might be the best predictors at another school, he concluded that the differences between schools would probably involve curriculum content and grading. If DAT content and dental school curriculum content and faculty grading criteria were similar, the correlations were high, he found; but if the faculty considered other areas important and evaluated these other areas not encompassed by the DAT, the correlation was low. Webb concluded that

since each school was unique in this way, the correlations would differ from school to school.

Although Webb's study is primarily of interest in a historical context, he drew one very interesting conclusion from the available data. He showed that, among all of the dental schools, students with high DAT scores made grades that covered the entire spectrum from high to low. However, students with low DAT scores never made high grades. Webb concluded that aptitude tests were more efficient as indicators of potentially poor students than as indicators of outstanding students.

In his study, Kramer⁵ compared the predictive value of the DAT to the Medical College Admission Test and Law School Admission Test. He concluded that median correlations for freshman and sophomore dental school grade point averages with DAT scores compared favorably with those reported for the medical and law school admission tests. Kramer also found that the DAT contributed unique information beyond that provided by pre-dental grade point averages.

Heller et al.⁶ identified a number of questions concerning the variables used to select students for admission to dental school. Postulating that a variable would only be a reliable predictor of dental school success if it were predictive for any class in any school, in 1965 they conducted a study of the entering freshman dental school classes in 1961, 1962, and 1963 at the University of Illinois College of Dentistry. They found that the DAT academic average composite score had a high correlation with academic grades for the 1962 class, but a very low correlation for the 1963 class. Heller et al. concluded that caution should be applied in using DAT academic average composite scores in selection processes. However, they also stated that the undergraduate grade point average may not be equivalent among schools since undergraduate grades represent varied policies at different institutions that may not be equal.

Another study from 1965, by Manhold and Manhold,⁷ produced results indicating that there was generally good predictive value for the DAT over the entire four years of dental school. They also found a very pronounced predictability above the .01 level of significance for the DAT academic aptitude composite score and basic science grades. Overall, Manhold and Manhold concluded that the best predictor of dental student performance was the academic aptitude composite score of the DAT. Phipps et al.⁸ came to a different conclusion. When these authors studied the value of the DAT as a predictor of success at the University of Pittsburgh School of

Dentistry using grade point average in dental school as the measure of success, they found that preprofessional grade point average measures were relatively independent of DAT scores and that the total preprofessional grade point average was the best predictor of dental school performance.

Kreit and McDonald⁹ emphasized the importance of each dental school analyzing its individual admissions criteria in order to accept the most qualified students. This study utilized the final dental school grade point average as the measure of success and found that the students' preprofessional grade point average and most portions of the DAT correlated significantly with the dental school grade point average, but the best single predictor of final grades in dental school was the college grade point average. Kreit and McDonald also found that the next most consistent predictors of final dental school grade point average were the academic average composite score and the DAT reading comprehension score.

Not all studies conducted in the 1960s and 1970s concluded that the DAT was a worthwhile predictor. Dworkin¹⁰ found the test was not a good predictor of total dental school performance when using dental school grades as the measure of success. He reported that the DAT had statistically consistent, but low, levels of correlation and therefore questioned the usefulness of the correlations. However, Dworkin did find that freshman and sophomore academic grades correlated significantly with some DAT scores, but still concluded that the test was an unreliable predictor of dental school success during the total four years.

A study conducted by Wood at the University of British Columbia from 1969 to 1976 reinforced Dworkin's conclusions. Wood¹¹ found that DAT reading comprehension scores were not correlated with any dental course grades; that DAT biology scores correlated with grades for three first-year courses; and that DAT total science composite scores and academic average composite scores correlated with grades in basic science courses. Wood concluded that although significant correlations existed between DAT scores and grades received in first- and second-year courses, these correlations were of little value.

Finally, in 1999, Kramer¹² correlated the Academic Average and Total Science composite scores for the DAT and the Part I average for the NBDE. He concluded that the correlations are stronger between the DAT and the Part I average for the NBDE than

for the pre dental science and non-science grade point averages and the Part I average.

The literature review reveals many differing opinions concerning the DAT. To provide current research on this topic, we tested the hypothesis that a student's DAT subtest score is a significant predictor of Part I of the NBDE scores.

Methodology

Our study consisted of students matriculating at the University of Mississippi School of Dentistry in 1992, 1993, 1994, and 1995 who completed the first two years of dental school and took Part I of the NBDE. The total number of students in these four classes was 114. The results are limited to the 114 student test scores for these cohort groups and reflect only DAT scores and NBDE Part I scores attained by students matriculating in those years. Of the 114 students, twenty-nine were admitted in 1992, twenty-seven in 1993, thirty-two in 1994, and twenty-six in 1995.

We received Institutional Review Board approval for this study from the University of Mississippi and the University of Mississippi Medical Center. This approval allowed us to gain access to the student scores on the DAT and Part I of the NBDE.

We manually recorded both sets of scores on a data collection sheet and coded the names for anonymity. To comply with the Family Education Rights and Privacy Act, all scores were identified exclusively by code number.

The independent variables were the DAT student scores, including perceptual ability, quantitative analysis, reading comprehension, biology, general chemistry, and organic chemistry. Two additional composite scores, academic average and total science, also reported as part of the DAT, were not used in this study because they incorporate some of the six individual scores. The dependent variables were the NBDE Part I student scores, including anatomic sciences, biochemistry-physiology, microbiology-pathology, and dental anatomy and occlusion. One additional average composite score also reported as part of the NBDE Part I was not used in this study because it incorporates the four individual scores.

The regression methodology design of the study used simultaneous multiple regression analysis to examine relationships using NBDE Part I student scores for each of the basic science areas as the dependent variables and the DAT student scores as

the independent variables. In all cases of analysis, a p value of less than or equal to .05 was used to determine significance.

Results

Four analyses were performed, each corresponding to one of the basic science areas on Part I of the NBDE. First, a regression analysis was performed in which the DAT measures of perceptual ability, quantitative analysis, reading comprehension, biology, general chemistry, and organic chemistry were the independent variables and the anatomic sciences subtest of Part I of the NBDE was the dependent variable. This resulted in a significant regression model ($F[6,106] = 6.68, p < .01$) with $R = .524$ and $R^2 = .274$, meaning that the DAT scores explained 27 percent ($r = .274$) of the variance in the NBDE anatomic sciences subtest. As noted in Table 1, reading comprehension was the only significant predictor ($t = 2.76, p < .01$) of the anatomic sciences subtest. Thus, an increase in DAT reading comprehension student scores was associated with an increase in NBDE anatomic sciences student scores.

A second regression analysis was performed in which the DAT measures of perceptual ability, quantitative analysis, reading comprehension, biology, general chemistry, and organic chemistry were the independent variables and the biochemistry-physiology sub test of Part I of the NBDE was the dependent variable. This resulted in a significant regression model ($F[6,106] = 6.99, p < .01$) with $R = .532$ and $R^2 = .283$, meaning the DAT scores explained 28 percent ($r = .283$) of the variance in the NBDE biochemistry-physiology subtest. As noted in Table 2, reading comprehension ($t = 2.41, p < .05$), biology ($t = 2.04, p < .05$), and organic chemistry ($t = 2.10, p < .05$) were the only significant predictors of the biochemistry-physiology subtest. The increases in DAT reading comprehension scores, DAT biology scores, and DAT organic chemistry scores were associated with an increase in NBDE biochemistry-physiology scores.

In a third regression analysis, the DAT measures of perceptual ability, quantitative analysis, reading comprehension, biology, general chemistry, and organic chemistry were the independent variables, and the microbiology-pathology sub test of Part I of the NBDE was the dependent variable. This resulted

Table 1. Coefficients for a regression of the anatomic sciences subtest of Part I of the National Board Dental Examinations on six subtests of the Dental Admission Test

Model	Unstandardized Coefficients		Standardized Coefficients	t	p-value
	B	Standard Error	Beta		
(Constant)	53.406	4.919		10.857	.000
DAT Perceptual Ability	.248	.191	.118	1.293	.199
DAT Quantitative Analysis	9.738E-02	.218	.044	.446	.657
DAT Reading Comprehension	.567	.205	.257	2.767	.007
DAT Biology	.257	.285	.089	.903	.369
DAT General Chemistry	.311	.216	.157	1.442	.152
DAT Organic Chemistry	.298	.220	.129	1.358	.177

DAT = Dental Admission Test

Table 2. Coefficients for a regression of the biochemistry-physiology subtest of Part I of the National Board Dental Examinations on six subtests of the Dental Admission Test

Model	Unstandardized Coefficients		Standardized Coefficients	t	p-value
	B	Standard Error	Beta		
(Constant)	50.741	5.369		9.450	.000
DAT Perceptual Ability	6.317E-02	.209	.027	.301	.763
DAT Quantitative Analysis	.151	.238	.062	.632	.529
DAT Reading Comprehension	.538	.224	.222	2.407	.018
DAT Biology	.634	.311	.199	2.042	.044
DAT General Chemistry	.167	.236	.077	.708	.481
DAT Organic Chemistry	.503	.240	.198	2.099	.038

DAT = Dental Admission Test

in a significant regression model ($F[6,106] = 4.75$, $p < .01$) with $R = .460$ and $R^2 = .212$, which means that DAT scores explained 21 percent ($r = .212$) of the variance in the NBDE biochemistry-physiology subtest. As noted in Table 3, reading comprehension was the only significant predictor ($t = 2.81$, $p < .01$) of the microbiology-pathology subtest. An increase in DAT reading comprehension scores was associated with an increase in NBDE microbiology-pathology scores.

The fourth regression analysis was performed in which the DAT measures of perceptual ability, quantitative analysis, reading comprehension, biology, general chemistry, and organic chemistry were the independent variables, and the dental anatomy and occlusion sub test of Part I of the NBDE was the dependent variable. This resulted in a significant regression model ($F[6,106] = 7.78$, $p < .01$) with $R = .553$ and $R^2 = .306$, which means that the DAT scores explained 30 percent ($r = .306$) of the variance in the NBDE biochemistry-physiology subtest. As noted in Table 4, reading comprehension ($t = 3.57$, $p < .01$) and quantitative analysis ($t = 3.15$, $p < .01$) were the only significant predictors of the dental anatomy and occlusion subtest. The increases in DAT reading comprehension scores and quantitative analysis scores

were associated with an increase in NBDE dental anatomy and occlusion scores.

Discussion

The results of this study provide the first recent evidence of the predictive nature of student scores on the subtests of the Dental Admission Test in relation to student performance on Part I of the National Board Dental Examinations. These results may help provide dental school faculties with a foundation for understanding the way the DAT can be interpreted and related to students' future performance on Part I of the NBDE.

Four of the six individual areas examined by the DAT were statistically significant predictors of at least one subtest of Part I of the NBDE. R^2 are weak for all relationships. The DAT scores in perceptual ability and general chemistry were not significant predictors of student performance on any of the subtests of Part I of the NBDE. DAT scores in biology, organic chemistry, and quantitative analysis were all predictive of student performance on one of the subtests of Part I of the NBDE. Although this study has produced a number of statistically signifi-

Table 3. Coefficients for a regression of the microbiology-pathology subtest of Part I of the National Board Dental Examinations on six subtests of the Dental Admission Test

Model	Unstandardized Coefficients		Standardized Coefficients		p-value
	B	Standard Error	Beta	t	
(Constant)	61.672	4.697		13.130	.000
DAT Perceptual Ability	2.043E-02	.183	.011	.112	.911
DAT Quantitative Analysis	.104	.209	.051	.499	.619
DAT Reading Comprehension	.550	.196	.272	2.813	.006
DAT Biology	.416	.272	.157	1.532	.129
DAT General Chemistry	.130	.206	.072	.632	.528
DAT Organic Chemistry	.188	.210	.089	.897	.372

DAT = Dental Admission Test

Table 4. Coefficients for a regression of the dental anatomy and occlusion subtest of Part I of the National Board Dental Examinations on six subtests of the Dental Admission Test

Model	Unstandardized Coefficients		Standardized Coefficients		p-value
	B	Standard Error	Beta	t	
(Constant)	57.193	4.672		12.240	.000
DAT Perceptual Ability	-7.890E-03	.182	-.004	-.043	.965
DAT Quantitative Analysis	.653	.207	.303	3.149	.002
DAT Reading Comprehension	.695	.195	.324	3.569	.001
DAT Biology	7.358E-02	.270	.026	.272	.786
DAT General Chemistry	9.887E-02	.205	.051	.482	.631
DAT Organic Chemistry	.162	.209	.072	.774	.440

DAT = Dental Admission Test

cant predictor relationships between student scores on subtests of the DAT and performance on Part I of the NBDE, only one of the relationships evidences real consistency as a predictor. The most consistent predictor relationship ($r=.390$ to $.428$) exists between student scores in reading comprehension and student performance on Part I of the NBDE. The DAT reading comprehension score was moderately predictive of student performance on all of the subtests of Part I of the NBDE. The fact that the reading comprehension portion of the DAT was significantly related to all of the subtests of Part I of the NBDE seems to underscore the importance of this basic academic ability and indicates that it is necessary for a student to have good reading comprehension to enhance his or her ability to test well in the basic sciences. The ability to read well and to understand what has been read is essential to understanding the complex details of the basic sciences.

It is our hope that the results of this study will generate discussion among admission committee members concerning the selection of those individuals able to perform best in the unique dental school environment. There are a number of interesting questions that admission committee members may want to consider:

- In making admission decisions, should a dental school assign greater importance to the subtests that are most closely related to their students' eventual success on the NBDE?
- Should the reading comprehension subtest be weighted more heavily in making admission decisions to increase the percentage of students who pass Part I of the NBDE?
- Should the dental schools encourage students currently enrolled to work on improving their reading comprehension skills to prepare for Part I of the NBDE?
- And should reading comprehension in English be a required competency since Part I of the NBDE is an examination given only in English?

A limitation of this study was that the study population was only 114 students accepted to a single school of dentistry. Replicating this study in different dental schools to examine if the findings are similar or different would provide a basis for determining if these results can be generalized across all dental school populations. Comparing the results between dental schools located in metropolitan areas and dental schools in nonmetropolitan areas would provide additional information as to whether the results can be generalized across all dental schools. Such a com-

parison may prove valuable in customizing the admission process.

Also, comparing the results between dental schools with large class sizes and those with small class sizes may enable schools to better determine those individuals who will do well in their own environment. Further, comparing the results between dental schools with geographic limitations for admission and those without such limitations might also provide information that would enable schools to customize the admission process.

Additional research is needed concerning the reading comprehension portion of the DAT and why it is a consistent predictor of student performance on Part I of the NBDE. This research might include inquiry into the importance of the sequencing of classes since reading comprehension seems to be the basis upon which other skills are built.

Further examination is also warranted for the subtests of the DAT that are not significant predictors of Part I of the NBDE. Additional analysis would provide more information on the relationship between perceptual ability and general chemistry and student performance on Part I of the NBDE. Additional investigation may also determine if the DAT perceptual ability subtest predicts performance in clinical settings and licensing examinations rather than performance on Part I of the NBDE.

Although this study provides insight into the relationship between student scores on the DAT and performance on Part I of the NBDE, the findings suggest that there are many additional questions to be explored.

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