Evidence Suggesting We Should Admit Students Who Score Extremely Low on GRE Subtests or the GMAT to Graduate School Programs

By Ted Micceri, Ph.D.

Budgets, Human Resources and Information Technology
Budgets and Policy Analysis
Office of Institutional Research

Paper Presented at the AIR Forum 2002
Toronto, Canada, June 2-6

Evidince Suggesting We Should Admit Students Who Score Extremely Low on GRE Subtests or the GMAT to Graduate School Programs

Abstract

This study sought to determine whether GRE subscores (or GMAT) could predict graduation rates in related areas (math-oriented majors for GRE quantitative, etc.) in a sample of over 9,000 graduate students at a major public research university. Because few low quantitative scores were present in math-oriented majors, an attemp was made to determine whether thresholds occurred below which students would fail to graduate by grouping scorers (e.g. <400, 400-499, 500-599, 600+). Surprisingly, lower scoring groups (particularly < 400) graduated at consistently and sometimes substantially higher rates than higher scoring groups. Possible reasons for this phenomenon are explored.

Introduction and Purpose

Because test makers generally recommend against using total scores in evaluation,[1] this study's primary purpose was to determine whether subtest scores on the GRE (quantitative and verbal) or total GMAT scores would prove better predictors of graduate student success than total GRE scores, and particularly so in fields emphasizing either quantitative methods (mathematics, physics, engineering, physical sciences, etc.) or language (English, communication, literature, history, etc.). Due to small samples for advanced graduate students, only beginning graduate students were included in this analysis.

Background

Recently, the status of graduate education has begun to receive national consideration. Lovitts & Nelson (2000) note: "...applications to graduate school in several disciplines have begun to decline—not only because well-paid high-tech employment is luring potential students away, but also because the news about the long-term collapse of the academic job market has finally penetrated the undergraduate culture." Perhaps as a result of these phenomena, greater attention is being paid to graduate retention today than ever before. Of course, one might assume that improved selection criteria would result in better graduate retention. One cheap (for the institution), readily available, and the fallaciously assumed-to-be-objective selection tool[2] is test scores. Therefore, considerable attention has been placed on these. However, findings indicate that they do not predict graduate success very well, if at all.

Xiao (1998) in a 6-year study of 2,200 master's students at Northern Illinois University, found that incoming GRE had no effect except in engineering, where higher GRE scores associated with longer time to completion.

Others reporting similar findings among graduate students include (Onasch, 1994; House and Johnson, 1992 and Steinberg & Williams (1997). Onasch did find that higher undergraduate GPAs associated with less time to degree among graduate students. Arguably, one possible reason for the lack of relationship between test scores and success may be the restriction of range resulting from selection, however, statistics reported in the

[1] This was done in an earlier study showing no relationship between GRE or GMAT scores and graduate success (Micceri, 2000).

[2] For an extensive literature review on the lack of validity of tests, see: Micceri (2000). W*hy Do We Waste So Many Resources on Incredibly Costly and Practically Worthless Standardized Tests?* – Available under Enrollment Management: Recruitment & Admissions: 4/2001 at http://usfweb.usf.edu/bpa/oir/studies.htm

Methods Section (Limitations) show this isn't really true for USF, and probably not any more true at the other Metropolitan Institutions where the studies above were conducted.

Methods

Because this study emphasizes analysis at the major level, and due to sample size limitations at that level, only beginning graduate students (seeking M.A. or M.S. degrees) were used in this study, and only those having an adequate time to earn a graduate degree: (1) for analysis at the college level, 1990 through 1996 cohorts were used, giving 2.67 years for the last cohort to earn a degree, and (2) for analysis at the major level, the 1990 through 1997 cohorts were used, giving 1.67 years for the last cohort to earn a degree.

For analyses at the college level, two random samples were drawn from the data to cross-validate results.

In order to investigate the threshold issue (Does some point exist above which students must score to succeed in graduate school?), test scores were divided into four groups for GRE quantitative and verbal and GMAT. All students scoring below 400 were placed into one group; those between 400 and 499 in another, those between 500 and 599 in a third and finally, the highest scoring group included those scoring between 600 and 800. The lowest subscores were on the order of 200.

Limitations

Although restriction of range may be a slight factor in reducing correlations between subtests and graduation, this did not appear much of a problem. Among the total populations upon which correlations were conducted, for the quantitative GRE subtest, 9% of all scores were below 400 and 20% were below 500, while 30% were 600 or above. For the verbal subtest, 12% were below 400 and 28% were below 500 while 16% were 600 or above. For both quantitative and verbal, minimum scores of 200 occurred more than once.

The proportion of various cohorts lacking test data, largely because these data were never entered in the admissions files, ranged from 7% for the 1990 cohort to 24% for the 1997 cohort. Although it is possible that the population lacking test scores may differ significantly from other students, and may therefore have somewhat altered relationships between tests and graduation, the fact that between 85% and 93% of most available cohorts had scores (only 76% in 1997), indicates that any such effects should be comparatively minimal. Also note that a substantial number of students who lack tests are foreign students, and that due to language biases inherent in these tests, scores for such students tend to be even less valid than do those for speakers of American Standard English. Thus, if their scores were present, we should most probably expect them to confound rather than clarify any relationships between test scores and graduation.

Findings and Discussion

Analyses were first conducted at the college level, then at the level of math and language-oriented majors. Figure 1 suggests that among math-oriented major fields, scores on the quantitative section of the GRE tend to be substantially greater than on the verbal section. However, there is, at best, miniscule evidence that higher scores on either the quantitative or verbal sections related to earning a degree.[3] In mathematics itself, interestingly enough, slightly higher scores on both verbal and math sections of the test associate with those earning degrees. However, these differences are neither significant nor important,

[3] Quan-Deg – represents the mean quantitative score for those earning degrees

particularly when one considers that the standard error of difference for these sub-tests is probably about 40 points (ETS, 2001).

The bottom panel shows that students in the language-oriented majors are more likely to have balanced quantitative and verbal scores. Again, no differences occur between those earning and not earning degrees in any of the situations. In English itself, it appears that those scoring higher on both the quantitative and verbal sections are less likely to graduate. That this exactly counters the effects for mathematics suggests that any apparent differences are most likely random occurrences.

The data investigated here do not suggest that GRE scores relate to success in graduate school for USF students admitted to specific programs, even in areas where one might expect them to show a specific relationship (e.g. mathematics or English). However, it should be noted that students in mathematics, both those who earned and who failed to earn a degree show somewhat higher mean quantitative scores than do students in the other sciences, and considerably higher quantitative scores than students in the language-oriented fields. A similar effect occurs for language-oriented fields, in which English majors show the highest verbal scores, while those in other language-oriented disciplines show somewhat lower scores. It could be that some threshold score exists below which students have difficulty. It is also possible that due to competition for spots, few, if any who score this low are ever admitted, thus, all who enter may be above such a threshold.

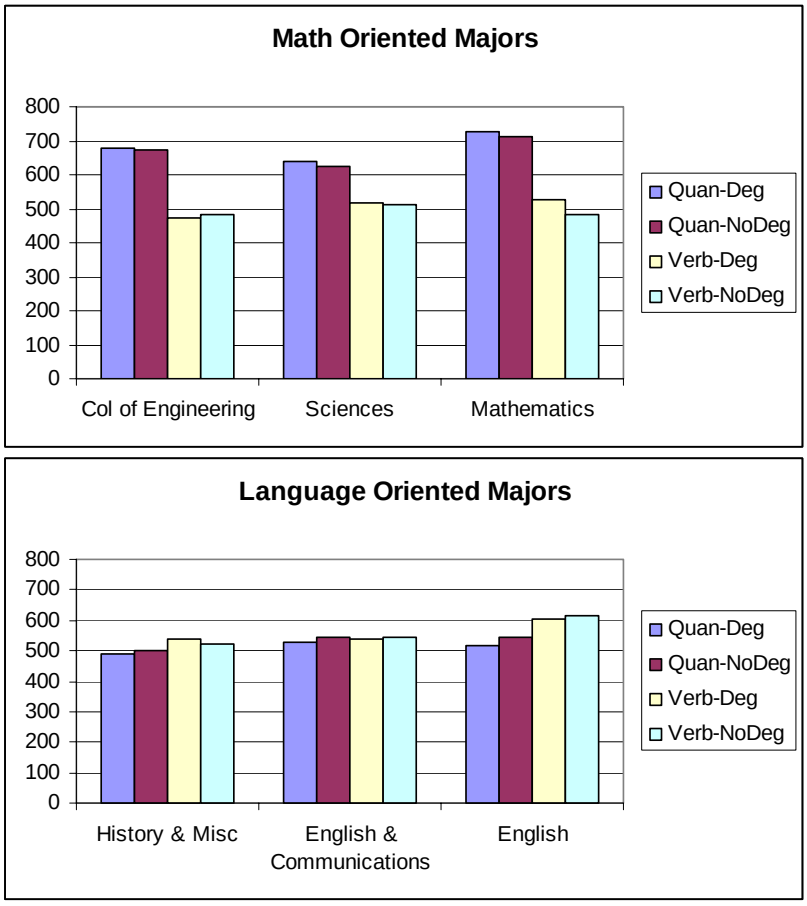

Figure 1
Mean Quantitative and Verbal Comparisons for Math and Language-Oriented Majors – 1990-1996 Cohorts

Surprising Results from an Investigation of Threshold Possibilities

In order to investigate this threshold issue, test scores were divided into four groups for GRE quantitative and verbal and GMAT. All students scoring below 400 were placed into one group; those between 400 and 499 in another, those between 500 and 599 in a third and finally, the highest scoring group included those scoring between 600 and 800. The lowest scores were on the order of 200.

Table 1 provides the total numbers of students with a given subtest (or GMAT) score, the percent in each of the four categories that graduated within a given college and the percent of all scores for that college that this group (e.g. between 400 and 499) represent.

Interestingly, and surprisingly as well, the consistently higher graduation rates tend to associate with the lowest test score group (< 400) rather than with the highest scoring group (600 to 800). This occurred in five of seven cases for the Quantitative GRE subtest (engineering lacked any cases below 400, so only seven cases occurred), six of eight times for verbal GRE and also for the GMAT. Thus, in 12 of 16 cases, the lowest scoring groups showed the greatest graduation rate. Rather than suggesting a threshold indicating success, these findings point in exactly the opposite direction: higher scores on tests past the point of 400 appear to reflect a threshold indicating a lower graduation probability.

Again, interestingly and surprisingly, the lower scores (below 500), in most situations exhibited higher graduation rates than the higher scores (500 or above). It is not that any of these differences individually are important, but rather, the consistency of the effects that make this a meaningful finding.

Table 1

Graduation Rates Within Colleges by GRE Verbal or GMAT Group – 1990 - 1997 Cohorts

	N	% Graduating				% of All Taking Test			
	All	< 400	400-499	500-599	600+	< 400	400-499	500-599	600+
GRE - Quantitative									
Total	7,514	67%	67%	63%	60%	9%	11%	28%	30%
Architectur	121	0%	51%	38%	37%	2%	15%	33%	34%
Arts & Sci	3,051	61%	62%	62%	57%	10%	14%	30%	24%
Education	1,900	75%	73%	70%	74%	12%	13%	26%	15%
Ed Jnt Mjrs	339	48%	52%	52%	53%	9%	15%	38%	22%
Engineering	969		55%	58%	59%	0%	1%	12%	87%
Fine Arts	128	61%	80%	65%	55%	18%	8%	27%	17%
Nursing	406	80%	86%	83%	77%	13%	6%	28%	13%
Pub Health	600	70%	60%	55%	62%	4%	11%	35%	34%
GRE - Verbal									
Total	9,214	73%	64%	59%	61%	10%	15%	31%	16%
Architectur	121	55%	44%	21%	44%	17%	29%	24%	7%
Arts & Sci	3,052	70%	61%	56%	62%	9%	15%	31%	20%
Education	1,901	81%	73%	69%	67%	15%	14%	23%	11%
Ed Jnt Mjrs	339	63%	54%	46%	53%	8%	20%	31%	17%
Engineering	971	71%	57%	59%	50%	17%	19%	24%	15%
Fine Arts	128	67%	68%	62%	80%	14%	14%	27%	16%
Nursing	406	82%	84%	83%	81%	10%	8%	28%	12%

	N	% Graduating				% of All Taking Test			
	All	< 400	400-499	500-599	600+	< 400	400-499	500-599	600+
Pub Health	600	64%	58%	57%	65%	9%	19%	32%	14%
GMAT									
Business	1,696	78%	61%	59%	56%	1%	14%	46%	18%

Thresholds at the Major Level for Quantitative-oriented and Language-oriented Majors

Table 2 provides graduation rates and percentages of populations by major within college for quantitative-oriented majors on the quantitative GRE. Table 3 provides these data for verbal-oriented majors on the verbal subtest. In Table 2, in five of 13 situations the highest scoring group (600+) showed the highest graduation rates. On the other hand, in eight of 13 situations, the lowest scoring group having any members showed the highest rate. Among the quantitative-oriented majors, mathematics had only quantitative scores of 500-599 or 600+, and, those between 500-599 graduated at a greater rate than those at or above 600. In physics, there was a monotonic negative relationship between graduation rates and GRE quantitative scores, with the higher graduation rates occurring among lower scoring groups[4]. Students in mathematics education also showed a monotonic negative trend. Only in the college of engineering did any results equal expectations. In Computer Science, Electrical, Engineering Management, Industrial and Mechanical engineering, higher scoring groups graduated at a higher rate than lower scoring groups. However, for Chemical and Civil majors, the opposite held true. Thus, the results are clearly mixed for quantitative-oriented majors with eight having negative and seven positive trends associating with GRE subtest scores.

Table 2
Graduation Rates Within Departments by GRE Quantitative Group – 1990 - 1997

	Totals	% Graduating				% of All Students in Major			
	All	< 400	400-499	500-599	600+	< 400	400-499	500-599	600+
Arts & Sciences									
Chemistry	20	-	100%	50%	53%	0%	< 1%	10%	85%
Microbiology	44	100%	50%	50%	61%	2%	7%	32%	52%
Marine Science	79	-	64%	43%	47%	0%	5%	27%	59%
Mathematics	36	-	-	100%	66%	0%	0%	3%	97%
Physics	46	-	100%	75%	54%	0%	< 1%	9%	89%
Education Joint Majors									
Math Ed	46	-	100%	75%	62%	0%	< 1%	35%	63%
Engineering									
Chmcl Eng	48	-		67%	50%	0%	0%	13%	88%
Civil Eng	226	-	100%	62%	61%	0%	< 1%	21%	78%
Cmptr Eng	40	-			45%	0%	0%	0%	100%
Cmptr Sci	151	-		44%	47%	0%	0%	6%	94%
Elec Eng	233	-	50%	58%	62%	0%	< 1%	8%	91%
Eng Mgt	150	-	33%	63%	74%	0%	3%	18%	78%
Indstr Eng	40	-		0%	59%	0%	0%	3%	98%
Mech Eng	74	-		33%	56%	0%	0%	8%	92%

[4] Note - the 400-499 group had only one member, who graduated, thereby creating a 100% rate for that subgroup.

Table 3 shows that in only one of 13 possible situations (for English as a 2nd language majors) among what might be termed verbal-oriented majors, did the highest scoring group on the GRE show the highest graduation rate. On the other hand, in two of nine situations the lowest scoring group (below 400) showed the highest graduation rates. Similar to mathematics, in 10 of 13 situations, students scoring between 500 and 599 graduated more frequently than did those with 600 or more. However, in only five of 13 cases did those scoring between 400 and 499 graduate at a greater rate than those scoring higher (either 500-599 or 600+). Further, in only three of nine cases did those scoring below 400 have the highest graduation rate. Specifically, English majors scoring between500-599 showed a higher graduation percentage than those at 600 or above. However, the 4% of English majors scoring between 400 and 499 on the verbal graduated less frequently. Among English as a second language majors, the two higher scoring groups (500-800) graduated at a greater percentage rate than did those who scored between 400 and 499; however, among Linguistic majors, those below 400 showed the highest graduation rates. As with the quantitative subscores, the results are mixed for verbal-oriented majors.

Table 3
Graduation Rates Within Departments by GRE Verbal Group – 1990 - 1997

		% Graduating				% of All Students in Major			
	N	< 400	400-499	500-599	600+	< 400	400-499	500-599	600+
Arts & Sciences									
Communication	39		58%	64%	60%	0%	13%	56%	13%
English	104		33%	57%	48%	0%	4%	42%	52%
Engl 2nd Lng	21		64%	100%	100%	0%	19%	19%	29%
French	22	20%	63%	50%	33%	23%	14%	27%	14%
History	104	0%	46%	30%	59%	1%	14%	41%	31%
Lib&Info Sc	494	82%	80%	79%	76%	8%	7%	28%	31%
Linguistics	97	60%	41%	56%	46%	10%	21%	26%	29%
Mass Comm	147	17%	61%	41%	44%	4%	18%	28%	23%
Philosophy	35	0%	33%	63%	29%	3%	23%	23%	40%
Education									
Reading Ed	35	67%	50%	88%	0%	17%	26%	23%	9%
Education Joint Majors									
English Ed	101	60%	59%	42%	43%	5%	16%	36%	21%
Business - GMAT									
Economic	24	-	43%	67%	25%	0%	17%	38%	33%
Acctncy	316	0%	71%	70%	63%	< 1%	9%	48%	19%

Conclusion

The findings of this study fail to suggest that GRE subscores relate to success in graduate school for USF students admitted to specific programs, even in areas where one might expect them to show a specific relationship (e.g. mathematics or English). However, it should be noted that few students were admitted to either mathematics or English degree programs without having at least a 500 score on the relevant GRE subtest. This effect stimulated an investigation of the possibility that threshold subscore values exist below which students in a given area of study could not perform without difficulty. Table 2 and Table 3, however, do not provide much support for the concept of a threshold, because,

where students were admitted at lower test levels, they tended to graduate at a higher rate than those with higher test scores.

One admissions recommendation appears to result from this research, at least for those majors that are not either heavily language or math-oriented:[5] Completely reverse the criteria for admission to a graduate program. If you want higher graduation rates, then do not admit any students who score above 500 on a GRE subtest unless they are in a heavily language or math based subject, and in those subjects consider students scoring below 500 unless your graduation rates appear different from overall trends (e.g. generally in the college of engineering, again, a lack of cases for reasonable comparison occurred). In what might be termed "more balanced" fields, if admissions are limited to only students scoring below 400 on subtests, as opposed to those who score 500 or above, the gain in graduation rates ranges from a high of 19% on the GMAT, to a somewhat lesser 11% on the GRE quantitative, and finally, to a minimum of only about 4-7% for the GRE verbal (Table 1).

One might ask: "How could this possibly occur if these tests have any validity?" Several possible explanation appear possible.

First, all of the students included in this study had already completed a bachelor's degree prior to being admitted to graduate school. That a student would score below 400 on a GRE subtest suggests that they are poor test-takers. For the best and most intelligent students, poor test-taking ability can result from many factors, including, but not limited to a non-standard English background, severe test anxiety, specific learning disabilities, etc., etc. For such a student to accomplish an undergraduate degree, in which test-taking frequently is required for course success, we may probably assume that one of the following scenarios is true:

- Such a student almost must exhibit a high degree of motivation, and almost surely persistence as well. Either of these two factors could contribute to higher rates of success than for those who have a comparatively "easy" time with tests (like me).
- Despite these poor subtest scores, all of these students were admitted to a graduate degree program,[6] which suggests that they received either strong recommendations, or possibly that departments apply more stringent acceptance criteria to such students, [7] either of which could relate to increased graduation rates. These results suggest that if criteria differ between high and low-scoring students, applying the same criteria to all students would tend to increase graduation rates.
- It is conceivable that "better qualified" students are more likely to leave a master's program to take a job than those having what are generally considered to be "lower qualifications."
- If one assumes that standardized tests such as the GRE and GMAT have any validity[8], then one might consider these data to indicate that many of USF's graduate programs better serve less academically qualified than more academically qualified students.

[5] A lack of cases from which to make judgements occurred for the heavily language or math-oriented majors.
[6] Admittedly, this may have occurred following evidence of their capabilities while being enrolled as unclassified/non-degree-seeking students.
[7] Analyses failed to support the possibility that very high college GPA scores associated with such students.
[8] Almost all research in the vast testing literature indicates that such tests almost totally lack validity other than a low relationship with low-level undergraduate grades and a strong relationship with other such tests.

References

ETS (2001). *Test Characteristics of the SAT I: Reliability, Difficulty Levels, Completion Rates.* http://www.collegeboard.org/sat/cbsenior/stats/stat002.html

House and Johnson (1992). *Predictive Validity of Graduate Record Examination Scores and Undergraduate Grades for Length of Time to Completion of Degree.* Psychological Reports, 71, 1019-1022.

Lovitts, B.E. & Nelson, C. (2000). The Hidden Crisis in Graduation: Attrition from Ph.D. Programs. *Chronicle of Higher Education: Academe,* 86:6, pp. 44-50.

Micceri, T. (2001). *A Study of USF Graduate Students – Exploratory Analyses.* BPA- IR Analytical Report 200012_1. Available under Graduate Studies at: http://usfweb.usf.edu/bpa/oir/studies.htm.

Onasch, C. (1994) – *Undergraduate Grade Point Average and Graduate Record Exam Scores as Predictors of Length of Enrollment in Completing a Master of Science Degree.* (ERIC No: ED375739).

Steinberg & Williams (1997). *Does The Graduate Record Examination Predict Meaningful Success in the Graduate Training of Psychologists? A Case Study*. The American Psychologist, 52, 630.

Xiao, B. (1998). *Factors Influencing Master's Degree Attainment in Business, Engineering, Health and Human Sciences and Visual and Performing Arts*. Paper presented at the 1998 AIR Forum, Minneapolis, MN, May.