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ETS GRE® Board Research Report
ETS GRE®–14-03
ETS Research Report No. RR–14-26

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December 2014

The report presents the findings of a research project funded by and carried out under the auspices of the Graduate Record Examinations Board.

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GRE Board Research Report Series and ETS Research Report Series ISSN 2330-8516

RESEARCH REPORT

New Perspectives on the Validity of the *GRE*® General Test for Predicting Graduate School Grades

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Given the serious consequences of making ill-fated admissions and funding decisions for applicants to graduate and professional school, it is important to rely on sound evidence to optimize such judgments. Previous meta-analytic research has demonstrated the generalizable validity of the *GRE*® General Test for predicting academic achievement. That research does not address predictive validity for specific populations and situations or the predictive validity of the GRE Analytical Writing section introduced in October 2002. Furthermore, much of the past GRE predictive validity research is primarily based on approaches that are correlational and univariate only. Stakeholders familiar with GRE predictive validity mainly in the form of zero-order correlation coefficients might automatically interpret the usefulness of the GRE solely through the prism of Cohen's (1988) guidelines for judging effect sizes and without regard to the larger context. However, by using innovative and multivariate approaches to conceptualize and measure GRE predictive validity within the larger context, our investigation reveals the substantial value of the GRE General Test, including its Analytical Writing section, for predicting graduate school grades.

Keywords Predictive validity; utility; GRE; writing; graduate school; graduate school grades; dominance analysis

doi:10.1002/ets2.12026

Graduate and professional education is a limited and precious resource. For a relatively small number of available openings, competitive graduate programs often receive a large number of applications from individuals with impressive credentials but are able to admit only a small percentage of them. Given the high-level knowledge and skill of those who are admitted and then enroll, many graduate and professional students eventually go on to perform some of the most consequential work in society. Among their many undertakings, they develop cancer therapies, pursue economic reform, and manage geopolitical crises. Furthermore, teaching and training graduate and professional students can be extremely labor- and resource-intensive. Figures for actual total costs to programs are difficult to obtain, but the cost for a private organization to support a graduate fellow for 3 years comes to $125,000 ($41,667 per annum), excluding administrative fees (Wendler et al., 2010). Graduate and professional students and their families sometimes incur enormous financial and emotional costs so that students can pursue their education. In 2007–2008, the annual cost to master's degree students ranged from an average of $28,375 to $38,665, and the cost to doctoral students ranged from an average of $32,966 to $46,029 (Wendler et al., 2010).[1] Often it is the larger society, including taxpayers, who subsidize their training. To the extent that private industry finances graduate and professional school students, it shifts resources that might be invested toward other worthy causes and might pass costs onto consumers. Considering the stakes, admitting and providing resources to a student who will succeed in graduate or professional school should be a top priority. Although some errors in admissions and funding decisions might be unavoidable, educational institutions can minimize them by using sound assessment tools. The *GRE*® General Test is one such tool. Empirical research shows that, with the exception of undergraduate grade point average (UGPA), the GRE General Test predicts higher educational outcomes much more strongly than other types of information available for making admissions and funding determinations (e.g., personal statements and letters of recommendation; compare Kuncel, Hezlett, & Ones, 2001, and Kuncel, Wee, Serafin, & Hezlett, 2010, to Borneman, Cooper, Klieger, & Kuncel, 2007; Murphy, Klieger, Borneman, & Kuncel, 2009; and Vannelli, Kuncel, & Ones, 2007).

The main purpose of this research is to use various statistical methods to gain a greater perspective on the predictive validity of the GRE, particularly a better understanding of the practical significance of the zero-order correlation metric. The substantial majority of the results in large-scale validity studies of the GRE express predictive validity as zero-order correlation coefficients (e.g., Kuncel, Hezlett, et al., 2001; Kuncel et al., 2010; Powers, 2004). Cohen (1988) famously

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established a set of guidelines to assess the magnitude of a zero-order correlation, where a value of 0.10 is small, 0.30 is moderate, and 0.50 is large. However, many scholars explicitly or implicitly question the meaningfulness and usefulness of this framework, especially when there is a larger context to consider (see Ellis, 2010; Meyer et al., 2001). Furthermore, across program areas, admissions committees usually consider several pieces of information when making admissions decisions (Walpole, Burton, Kanyi, & Jackenthal, 2002). A stakeholder might ask if the GRE sections (Verbal Reasoning, Quantitative Reasoning, and Analytical Writing) provide any unique information (i.e., over and above what other predictors such as UGPA convey) that allows an admissions committee to better predict who will succeed in graduate school. Prior large-scale studies do provide some multivariate information, such as multiple correlations for GRE sections and UGPA, and permit one to assess how much variance the GRE explains over and above UGPA. However, this multivariate information is not typically broken out by separate domains of study. Additionally, it communicates validity for enrolled students only rather than for the applicant pool. We wanted to explore variability in multivariate validity across different types of graduate programs for optimally weighted GRE sections combined (as in a regression approach) and for incremental validity of the GRE sections over and above the variance in the graduate grade point average (GGPA) outcome criterion that UGPA explains. Also, we sought to express multivariate validity for the applicant pool and not for just enrolled students. Since raw data were available, this study avoided challenges associated with using meta-analytically derived matrices of intercorrelations to derive multiple correlations (see discussion in Kuncel, Hezlett, et al., 2001, pp. 173 – 174). In addition, we were able to look at predictive validity (zero-order validity coefficients and multivariate validity metrics) for the applicant pool by adjusting for range variation via multivariate methods (as did Burton & Wang, 2005, and Powers, 2004, for zero-order coefficients).

A secondary reason for this investigation is to explore the GRE's predictive validity for a sample from a state university system. The authors of GRE validity generalization research for graduate school admissions acknowledge that "there are variations in the generally high levels of predictive validity, leaving open questions about the validity of the GRE for specific populations and situations" (Kuncel et al., 2010, p. 341). Our aggregation and grouping decisions were based on the desire to convey validity information for what we believed were meaningful groups and a concurrent desire to maintain reasonable sample sizes (*N*s and *k*s) to minimize sampling error. *We did not focus on the generalizability of the validity coefficients in the sense that statistical methods were not used to determine, within the subgroups for which we reported validity information (i.e., degree levels and program areas), whether or not there were subpopulations with diverse validity coefficients that should be separately reported.* As described below, the data are limited to a recent 5-year period for public 4-year universities within a single U.S. state. Previous research (Kuncel, Hezlett, et al., 2001) has already empirically established the generalizable validity of the GRE examinations. Examination of demographically based differences in prediction (usually based on race/ethnicity and/or gender) takes the form of regression-based predictive bias studies. With the exception of findings that the GRE examinations over-predict the graduate school performance of some racial and ethnic minority populations, studies have not shown statistically or practically significant differences in prediction across demographic groups (see Kuncel & Klieger, 2012).

Methods

Description of the Database

The State University System (SUS) of Florida Board of Governors provided much of the data used in this study, including applicants' UGPAs; whether or not applicants to graduate school were admitted and enrolled; and academic records of enrolled students, including course names and grades, area of study (i.e., major), and graduation status. SUS data covered the academic years 2003 – 2004 through 2007 – 2008 and included information for any student who had either applied or who was enrolled at any point during those years. SUS data included applicant and enrolled student records from 10 public universities with doctoral and/or master's level graduate programs. Based on the Carnegie classification system, eight of the universities are considered doctoral-granting: Of these eight institutions, four of them have very high research activity (RU/VH), two have high research activity (RU/H), and two are doctoral/research universities (DRU). The other two institutions are classified as master's colleges and universities with larger programs (master's/L). SUS data initially included approximately 400,000 student records (many of which lacked necessary information and were subsequently removed).

Available GRE data were linked to data that SUS provided. This information included GRE scores for up to three GRE General Test administrations and data from the GRE Background Information Questionnaire. GRE data covered

all test takers who sent a score report to one of the 10 SUS institutions or who listed one of those 10 institutions as their undergraduate school. Test dates ranged from October 2002 (when the GRE Analytical Writing section was added to the GRE General Test) through the end of 2007.[2] The GRE data initially contained 240,000 records.

The resulting matched files included 134,000 records after substantial data cleaning. The matching process employed algorithms that took into account missing, incomplete, or mildly discrepant data. Quality control procedures for the matching program indicated very high probabilities that data were accurately linked. About 78,000 matched records contained only admission information, and about 56,000 matched records contained course-level data for at least one term. We further restricted the dataset of enrolled students to those who had completed at least six graduate school courses where a grade was assigned so that we could assess validity for a stable criterion. Certain multivariate methods that adjusted effect sizes for range variation (described below) required UGPA information. In order to facilitate comparability of various metrics used to measure predictive validity, we wanted all analyses within a degree level (master's and doctorate) to use the same samples to the extent possible. Therefore, records that lacked UGPA information were removed. In addition, records between master's-seeking and doctorate-seeking students were split for reasons described below. Ultimately, data for 25,356 students — 21,127 master's-seeking students and 4,229 doctorate-seeking students — were analyzed. Classification of students as master's seeking or doctorate seeking was based on information that the SUS provided. Master's seekers were students who the SUS indicated were seeking only a terminal master's degree in their SUS programs, and doctorate seekers were students who the SUS indicated were ultimately seeking a doctoral degree in their SUS programs (either with or without a requirement that a master's degree be obtained en route in their doctoral program).

Description of the Sample

Demographics

Although sample sizes vary slightly across demographic variables, demographic information was available for a relatively common set of approximately 20,000 master's level students and a relatively common set of approximately 4,000 doctoral level students. We believe that differences in *N*s across these variables are due primarily to a greater ability and willingness of GRE examinees to disclose certain demographic information more than other demographic information. Tables 1 – 8 provide demographic information for the overall master's level and doctoral level samples, as well as for specific program areas for each of these degree levels. These program areas are based on two-digit Classification of Instructional Programs (CIP) codes (National Center for Education Statistics [NCES], 2012). Title IV of the Higher Education Act of 1965 (as amended, 2003) requires all postsecondary institutions in the United States that participate in or apply to participate in federal student financial aid programs (more than 7,500 institutions) to reply to annual surveys that NCES's Integrated Postsecondary Education Data System (IPEDS) issues to monitor trends in postsecondary education (NCES, 2012, 20 USC 1094, Section 487[a][17] and 34 CFR 668.14[b][19]). Developed with the input of a technical review panel consisting of a broad range of federal agencies, state agencies, and postsecondary institutions, the CIP code taxonomy is the accepted U.S. federal standard that NCES created to track fields of study (NCES, 2012). For creating comparison groups in research, CIP codes provide flexibility that is useful for graduate-only institutions, as well as institutions that issue baccalaureate degrees (see discussion in Sykes, 2011). One could combine two-digit CIP code categories into larger STEM (science, technology, engineering, and mathematics), humanities, and social science groupings, especially if one possesses a rationale for answering questions about predictive validity at those higher levels of analysis. However, as one can observe in the tables presented here, there is variability in the values of predictive validity and other metrics among program areas defined by two-digit CIP codes. Averaging these metrics further would result in loss of information that might be useful; therefore, we opted to report values that reflect this variance.

We report here descriptive data for gender, race/ethnicity, age, citizenship/residency, parental education, and degree objective when registering for the GRE examinations. Although the substantial majority of master's level students were female (66%), a slight majority of doctoral level students were male (51%). The gender composition for specific program areas appears in Tables 1 and 2. Racial and ethnic data appear in Tables 3 and 4. The substantial majority of graduate students at both the master's level (73%) and doctorate level (75%) self-reported as being non-Hispanic and White. Sample sizes for American Indian students were extremely small. Asian individuals comprised 3.6% of master's students and 4.3% of doctoral students. Ten percent of master's degree enrollees were Black students, as were 7.6% of doctoral students.

Table 1 Gender, Age, and Citizenship Status: Master's Seekers

			Gender		Age				Citizenship status			
General program	CIP code	# of schools per CIP code	*N*	Males(%)	*N*	Min	Max	*M*	*N*	U.S. citizen % (*N*)	Resident alien-permanent resident % (*N*)	Not U.S. citizen or resident alien % (*N*)
Agriculture & related sciences	01	2	194	38.7	195	20	58	30.2	195	95.9 (187)	2.1 (4)	2.1 (4)
Natural resources & conservation	03	7	165	43.0	166	19	45	24.9	163	92.6 (151)	2.5 (4)	4.9 (8)
Architecture & related services	04	6	569	55.5	572	21	58	25.1	568	93.1 (529)	4.1 (23)	2.8 (16)
Area, ethnic, cultural & gender studies	05	5	144	29.2	157	20	51	25.1	157	86.6 (136)	5.1 (8)	8.3 (13)
Communication, journalism, related programs	09	8	716	29.0	729	21	55	26.1	719	90.1 (648)	2.6 (19)	7.2 (52)
Computer & information services	11	8	278	81.7	282	20	60	27.3	277	64.6 (179)	9.0 (25)	26.4 (73)
Education	13	10	4,649	23.2	4,707	17	100	27.8	4,654	96.1 (4,473)	2.1 (96)	1.8 (85)
Engineering	14	7	1,481	79.7	1,503	20	62	29.3	1474	78.7 (1,160)	8.1 (120)	13.2 (194)
Engineering technologies & engineering related fields	15	2	141	75.2	141	16	54	26.5	141	87.9 (124)	5.0 (7)	7.1 (10)
Foreign languages, literature, & linguistics	16	6	238	29.4	240	21	53	25.9	238	86.1 (205)	8.4 (20)	5.5 (13)
Family & consumer sciences/human sciences	19	2	87	8.0	87	9	40	24.5	87	92.0 (80)	3.5 (3)	4.6 (4)
English language & literature/letters	23	9	552	31.5	564	20	55	25.7	552	97.6 (539)	1.8 (10)	0.5 (3)
Liberal arts & sciences, general studies & humanities	24	6	118	36.4	122	21	39	24.5	121	98.4 (119)	0.0 (0)	1.7 (2)
Library science	25	2	867	26.2	879	21	60	26.1	871	97.0 (845)	2.1 (18)	0.9 (8)
Biological & biomedical sciences	26	9	445	36.4	447	20	73	27.0	444	92.6 (411)	3.6 (16)	3.8 (17)
Mathematics & statistics	27	8	230	58.7	232	20	58	26.5	231	78.4 (181)	6.9 (16)	14.7 (34)
Multi/interdisciplinary studies	30	4	75	42.7	76	21	46	26.2	75	92.0 (69)	5.3 (4)	2.7 (2)
Parks, recreation, leisure & fitness studies	31	6	375	46.4	379	20	84	30.1	375	96.0 (360)	1.3 (5)	2.7 (10)
Philosophy & religious studies	38	5	81	56.8	81	21	44	27.2	81	96.3 (78)	1.2 (1)	2.5 (2)
Physical sciences	40	7	240	52.1	242	21	63	33.0	237	89.5 (212)	4.6 (11)	5.9 (14)
Psychology	42	9	461	21.9	464	21	61	33.7	463	91.8 (425)	3.7 (17)	4.5 (21)
Security & protective services	43	7	469	37.3	473	20	57	25.5	469	96.6 (453)	2.1 (10)	1.3 (6)
Public administration & social service professions	44	9	1,713	18.6	1,735	20	65	25.7	1,719	96.0 (1,651)	3.1 (54)	0.8 (14)
Social sciences	45	9	1,133	47.7	1,139	20	104	28.0	1,134	94.4 (1,071)	3.1 (35)	2.5 (28)
Visual & performing arts	50	6	744	45.2	751	19	65	28.1	743	94.8 (704)	2.8 (21)	2.4 (18)
Health professions & clinical services	51	10	3,772	15.4	3,819	20	67	27.1	3,766	94.9 (3,575)	3.7 (138)	1.4 (53)
Business, management & marketing	52	9	901	49.3	910	19	101	25.6	903	86.1 (777)	6.2 (56)	7.8 (70)
History	54	8	289	51.9	289	20	56	26.0	288	97.9 (282)	2.1 (6)	0.0 (0)
Overall (all general programs combined)		10	21,127	33.8	21,381	9	104	27.3	21,145	92.8 (19,624)	3.5 (747)	3.7 (774)

Note. CIP = classification of instructional programs; *M* = mean

Table 2 Gender, Age, and Citizenship Status: Doctorate Seekers

			Gender		Age				Citizenship status			
General program	CIP code	# of schools per CIP code	*N*	Males (%)	*N*	Min	Max	*M*	*N*	U.S. citizen % (*N*)	Resident alien-permanent resident % (*N*)	Not U.S. citizen or resident alien % (*N*)
Agriculture & related sciences	01	1	45	48.9	46	22	52	26.4	45	88.9 (40)	4.4 (2)	6.7 (3)
Natural resources & conservation	03	1	26	34.6	26	22	43	29.9	26	96.2 (25)	3.9 (1)	0.0 (0)
Architecture & related services	04	2	13	38.5	13	21	50	28.1	13	92.3 (12)	0.0 (0)	7.7 (1)
Communication, journalism, related programs	09	2	22	59.1	23	22	48	28.9	23	87.0 (20)	0.0 (0)	13.0 (3)
Computer & information services	11	4	100	86.0	102	21	55	30.3	97	56.7 (55)	10.3 (10)	33.0 (32)
Education	13	8	526	32.3	539	19	57	28.0	523	88.7 (464)	4.0 (21)	7.3 (38)
Engineering	14	6	656	79.4	670	20	98	29.9	653	75.5 (493)	5.5 (36)	19.0 (124)
Foreign languages, literature, & linguistics	16	3	50	40.0	50	22	62	27.3	50	92.0 (46)	6.0 (3)	2.0 (1)
Family & consumer sciences/human sciences	19	1	11	18.2	12	22	40	25.8	10	80.0 (8)	20.0 (2)	0.0 (0)
English language & literature/letters	23	4	137	40.9	137	20	54	27.2	137	96.4 (132)	2.2 (3)	1.5 (2)
Liberal arts & science, general studies & humanities	24	1	20	60.0	20	21	37	26.2	20	85.0 (17)	5.0 (1)	10.0 (2)
Library science	25	1	8	37.5	9	21	53	28.2	8	75.0 (6)	12.5 (1)	12.5 (1)
Biological & biomedical sciences	26	6	444	42.3	446	20	57	25.1	443	86.9 (385)	5.6 (25)	7.5 (33)
Mathematics & statistics	27	5	121	76.9	122	21	46	24.1	119	74.0 (88)	3.4 (4)	22.7 (27)
Multi/interdisciplinary studies	30	4	56	28.6	56	21	44	24.6	55	96.4 (53)	0.0 (0)	3.6 (2)
Parks, recreation, leisure & fitness studies	31	1	25	44.0	25	22	49	27.2	25	88.0 (22)	4.0 (1)	8.0 (2)
Philosophy & religious studies	38	3	106	65.1	106	21	39	26.5	103	97.1 (100)	1.9 (2)	1.0 (1)
Physical sciences	40	7	503	62.4	508	21	60	28.1	495	81.4 (403)	4.7 (23)	13.9 (69)
Psychology	42	6	415	32.3	417	20	67	32.3	414	96.6 (400)	1.2 (5)	2.2 (9)
Security & protective services	43	1	26	30.8	26	30	54	40.0	25	100.0 (25)	0.0 (0)	0.0 (0)
Public administration & social service professions	44	5	69	50.7	70	25	57	36.7	69	75.4 (52)	4.4 (3)	20.3 (14)
Social sciences	45	5	322	50.9	326	21	62	34.0	320	88.1 (282)	2.5 (8)	9.4 (30)
Visual & performing arts	50	3	37	62.2	38	20	41	25.5	37	89.2 (33)	2.7 (1)	8.1 (3)
Health professions & clinical services	51	8	331	20.8	337	20	48	25.0	332	95.8 (318)	2.4 (8)	1.8 (6)
Business, management & marketing	52	4	16	62.5	16	22	56	25.3	15	80.0 (12)	0.0 (0)	20.0 (3)
History	54	3	89	67.4	89	21	41	25.4	89	96.6 (86)	3.4 (3)	0.0 (0)
Overall (all general programs combined)		10	4,174	50.6	4,229	19	98	28.6	4,146	86.3 (3577)	3.9 (163)	9.8 (406)

Note. CIP = classification of instructional programs; *M* = mean.

Table 3 Race and Ethnicity: Master's Seekers

General program	CIP code	# schools per CIP code	*N*	American Indian/Alaskan Native/Native American % (*N*)	Asian, Asian American, Pacific Islander % (*N*)	Black/African American % (*N*)	Hispanic/ Latin American % (*N*)	White non-Hispanic % (*N*)	Other % (*N*)
Agriculture & related sciences	01	2	194	0.0 (0)	4.1 (8)	6.7 (13)	8.8 (17)	79.4 (154)	1.0 (2)
Natural resources & conservation	03	7	152	0.0 (0)	1.3 (2)	2.0 (3)	4.6 (7)	88.2 (134)	4.0 (6)
Architecture & related services	04	6	547	0.2 (1)	4.2 (23)	9.9 (54)	12.4 (68)	68.6 (375)	4.8 (26)
Area, ethnic, cultural & gender studies	05	5	139	0.0 (0)	1.4 (2)	9.4 (13)	18.7 (26)	64.8 (90)	5.8 (8)
Communication, journalism, related programs	09	8	668	0.3 (2)	3.7 (25)	13.3 (89)	13.3 (89)	64.8 (433)	4.5 (30)
Computer & information services	11	8	216	0.5 (1)	17.6 (38)	8.4 (18)	10.2 (22)	57.9 (125)	5.6 (12)
Education	13	10	4,513	0.4 (17)	1.7 (75)	9.4 (422)	9.0 (405)	77.0 (3,473)	2.7 (121)
Engineering	14	7	1276	0.4 (5)	10.6 (135)	6.3 (80)	12.9 (165)	66.8 (852)	3.1 (39)
Engineering technologies & engineering related fields	15	2	131	0.0 (0)	3.1 (4)	8.4 (11)	17.6 (23)	67.9 (89)	3.1 (4)
Foreign languages, literature, & linguistics	16	6	213	0.0 (0)	1.9 (4)	3.3 (7)	17.4 (37)	75.6 (161)	1.9 (4)
Family & consumer sciences/human sciences	19	2	83	0.0 (0)	3.6 (3)	13.3 (11)	6.0 (5)	75.9 (63)	1.2 (1)
English language & literature/letters	23	9	537	0.4 (2)	1.1 (6)	4.7 (25)	9.7 (52)	79.5 (427)	4.7 (25)
Liberal arts & sciences, general studies & humanities	24	6	119	0.8 (1)	1.7 (2)	11.8 (14)	10.9 (13)	68.1 (81)	6.7 (8)
Library science	25	2	854	0.1 (1)	3.5 (30)	8.9 (76)	6.8 (58)	77.9 (665)	2.8 (24)
Biological & biomedical sciences	26	9	421	0.0 (0)	6.9 (29)	5.7 (24)	6.7 (28)	75.8 (319)	5.0 (21)
Mathematics & statistics	27	8	199	0.0 (0)	9.6 (19)	6.0 (12)	7.0 (14)	73.4 (146)	4.0 (8)
Multi/interdisciplinary studies	30	4	73	0.0 (0)	5.5 (4)	6.9 (5)	8.2 (6)	74.0 (54)	5.5 (4)
Parks, recreation, leisure & fitness studies	31	6	366	0.6 (2)	3.8 (14)	8.2 (30)	6.8 (25)	79.2 (290)	1.4 (5)
Philosophy & religious studies	38	5	78	0.0 (0)	2.6 (2)	3.9 (3)	10.3 (8)	80.8 (63)	2.6 (2)
Physical sciences	40	7	223	0.5 (1)	1.4 (3)	5.4 (12)	7.6 (17)	83.4 (186)	1.8 (4)
Psychology	42	9	433	0.0 (0)	2.1 (9)	11.3 (49)	13.6 (59)	70.0 (303)	3.0 (13)
Security & protective services	43	7	460	0.2 (1)	2.2 (10)	10.7 (49)	9.1 (42)	74.8 (344)	3.0 (14)
Public administration & social service professions	44	9	1,681	0.4 (6)	2.0 (34)	16.5 (278)	10.1 (169)	67.9 (1,141)	3.2 (53)
Social sciences	45	9	1,091	0.5 (5)	2.7 (29)	10.5 (115)	8.6 (94)	72.9 (795)	4.9 (53)
Visual & performing arts	50	6	717	0.1 (1)	2.7 (19)	7.8 (56)	7.4 (53)	78.2 (561)	3.8 (27)
Health professions & clinical services	51	10	3,656	0.5 (18)	4.0 (146)	12.9 (471)	10.4 (379)	69.5 (2539)	2.8 (103)
Business, management & marketing	52	9	819	0.6 (5)	4.9 (40)	8.9 (73)	18.0 (147)	64.0 (524)	3.7 (30)
History	54	8	283	1.1 (3)	1.1 (3)	2.5 (7)	8.8 (25)	82.3 (233)	4.2 (12)
Overall (all general programs combined)		10	20,142	0.4 (72)	3.6 (718)	10.0 (2,020)	10.2 (2,053)	72.6 (14,620)	3.3 (659)

Note. CIP = classification of instructional programs.

Table 4 Race and Ethnicity: Doctorate Seekers

General program	CIP code	# schools per CIP code	*N*	American Indian/Alaskan Native/Native American % (*N*)	Asian, Asian American, Pacific Islander% (*N*)	Black/African American % (*N*)	Hispanic/Latin American% (*N*)	White non-Hispanic % (*N*)	Other % (*N*)
Agriculture & related sciences	01	1	41	0.0 (0)	2.4 (1)	4.9 (2)	12.2 (5)	78.1 (32)	2.4 (1)
Natural resources & conservation	03	1	24	0.0 (0)	0.0 (0)	0.0 (0)	4.2 (1)	95.8 (23)	0.0 (0)
Architecture & related services	04	2	12	0.0 (0)	8.3 (1)	8.3 (1)	0.0 (0)	83.3 (10)	0.0 (0)
Communication, journalism, related programs	09	2	20	0.0 (0)	0.0 (0)	0.0 (0)	15.0 (3)	85.0 (17)	0.0 (0)
Computer & information services	11	4	71	0.0 (0)	2.8 (2)	2.8 (2)	14.1 (10)	69.0 (49)	11.3 (8)
Education	13	8	480	0.0 (0)	1.3 (6)	16.0 (77)	8.8 (42)	69.6 (334)	4.4 (21)
Engineering	14	6	537	0.7 (4)	8.9 (48)	6.5 (35)	9.3 (50)	70.8 (380)	3.7 (20)
Foreign languages, literature, & linguistics	16	3	45	0.0 (0)	2.2 (1)	2.2 (1)	13.3 (6)	80.0 (36)	2.2 (1)
Family & consumer sciences/human sciences	19	1	10	0.0 (0)	10.0 (1)	30.0 (3)	0 (0)	60.0 (6)	0.0 (0)
English language & literature/letters	23	4	132	0.0 (0)	0.8 (1)	7.6 (10)	5.3 (7)	80.3 (106)	6.1 (8)
Liberal arts & science, general studies & humanities	24	1	16	0.0 (0)	0.0 (0)	6.3 (1)	12.5 (2)	81.3 (13)	0.0 (0)
Library science	25	1	7	0.0 (0)	0.0 (0)	14.3 (1)	14.3 (1)	71.4 (5)	0.0 (0)
Biological & biomedical sciences	26	6	399	0.25 (1)	4.5 (18)	5.8 (23)	7.8 (31)	77.2 (308)	4.5 (18)
Mathematics & statistics	27	5	94	0.0 (0)	10.6 (10)	5.3 (5)	4.3 (4)	73.4 (69)	6.4 (6)
Multi/interdisciplinary studies	30	4	53	0.0 (0)	3.8 (2)	9.4 (5)	3.8 (2)	83.0 (44)	0.0 (0)
Parks, recreation, leisure & fitness studies	31	1	23	0.0 (0)	0.0 (0)	4.4 (1)	8.7 (2)	87.0 (20)	0.0 (0)
Philosophy & religious studies	38	3	97	0.0 (0)	0.0 (0)	3.1 (3)	6.2 (6)	84.5 (82)	6.2 (6)
Physical sciences	40	7	432	0.0 (0)	5.3 (23)	6.0 (26)	8.1 (35)	76.4 (330)	4.2 (18)
Psychology	42	6	401	0.5 (2)	3.2 (13)	5.5 (22)	9.7 (39)	77.6 (311)	3.5 (14)
Security & protective services	43	1	24	0.0 (0)	0.0 (0)	12.5 (3)	4.2 (1)	79.2 (19)	4.2 (1)
Public administration & social service professions	44	5	59	0.0 (0)	8.5 (5)	11.9 (7)	8.5 (5)	64.4 (38)	6.8 (4)
Social sciences	45	5	294	0.34 (1)	2.4 (7)	4.8 (14)	8.8 (26)	77.9 (229)	5.8 (17)
Visual & performing arts	50	3	33	0.0 (0)	3.0 (1)	0.0 (0)	3.0 (1)	84.9 (28)	9.1 (3)
Health professions & clinical services	51	8	327	0.0 (0)	5.2 (17)	10.4 (34)	9.5 (31)	73.4 (240)	1.5 (5)
Business, management & marketing	52	4	13	0.0 (0)	15.4 (2)	15.4 (2)	15.4 (2)	53.9 (7)	0.0 (0)
History	54	3	88	0.0 (0)	1.1 (1)	5.7 (5)	4.6 (4)	85.2 (75)	3.4 (3)
Overall (all general programs combined)		10	3,732	0.21 (8)	4.3 (160)	7.6 (283)	8.5 (316)	75.3 (2,811)	4.1 (154)

Note. CIP = classification of instructional programs.

Approximately 10.2% of master's students self-reported as being of Hispanic origin, and so did 8.5% of doctoral level students. The mean age of master's level students was 27.3 years, while the mean age of doctoral level students was slightly older at 28.6 years. Tables 1 and 2 report age information for specific program areas. As described in Tables 1 and 2, the vast majority of students were U.S. citizens, with slightly more master's level students having U.S. citizenship (92.8%) than doctoral level students (86.3%). The highest educational levels of students' parents sometimes serve as a measure of students' socioeconomic status, so the maximum educational attainment level for either of an enrollee's parents is reported here. For example, if an enrollee's mother had earned a graduate degree and the enrollee's father had earned no higher than a bachelor's degree, then we counted that enrollee in the graduate degree category. We believe that, in general, the higher of the education levels would most accurately reflect the educational knowledge and influence that parents convey to an enrollee, which can affect an enrollee's educational goals, preparation, and attainment. Educational attainment was generally higher for one of the parents of doctoral level students than for one of the parents of master's level students. Of master's-seeking students, 30.7% had at least one parent who had earned a graduate or professional degree, versus 35.2% of doctorate-seeking students.

Tables 5 and 6 summarize these values across specific program areas and for other levels of educational attainment. Seventy-five percent of master's students indicated that they did not plan to seek a doctorate or postdoctorate position, while 24% indicated that they did plan to pursue a doctorate or a postdoctorate position. Among doctoral students, 12.3% had previously thought that they would pursue a terminal master's degree only, and only 2.8% thought that they would ultimately go on to a postdoctorate position. Tables 7 and 8 show these values for particular program areas and for less common educational objectives.

Scores on the Predictors (GRE and UGPA) and the Criterion (GGPA)

One can refer to Tables 9–14 for detailed information for specific program areas. GRE Verbal Reasoning scores for enrolled master's students tended to be only slightly greater than the average for applicants to the SUS system (master's mean = 472; overall test-taker mean = 465), but the master's student mean was substantially larger for those programs for which one would expect verbal ability to play a more central role (e.g., mean = 566 for English language and literature). Mean GRE Quantitative Reasoning scores were below the general applicant norm (master's mean = 553; overall test-taker mean = 584), but they were especially high for those SUS programs for which one would expect quantitative ability to play a more central role (e.g., mean = 727 for mathematics and statistics). The mean GRE Analytical Writing scores for master's students fell at about the overall test-taker average (4.11) but were higher for master's level students attending presumably more writing-intensive programs (e.g., mean = 4.69 for English language and literature). At the doctoral level, mean scores of SUS students were notably greater than the means for applicants to the SUS system, as well as master's level students enrolled in the SUS system: 521 for Verbal Reasoning, 642 for Quantitative Reasoning, and 4.44 for Analytical Writing. UGPAs for all students were generally high. For master's level students, the overall mean was 3.37 (slightly higher than a B+ average), and for doctoral students the overall mean was slightly higher at 3.54 (between a B+ and an A− average). GGPAs for all students were generally very high. For master's level students, the overall mean was 3.67 (slightly below an A− average), and for doctoral students the overall mean was slightly higher at 3.71 (slightly above an A− average). Variability in GGPA was relatively low at both the master's level ($SD = 0.36$) and doctoral level ($SD = 0.31$). Assuming a normal distribution of GGPA, about 84% of students attained at least a B+ average in graduate school in both master's and doctoral programs. Although this variability itself varies across program areas, it still seems restricted (never exceeding a standard deviation of 0.55 for a master's level program area or 0.49 for a doctoral level program area). Eighty percent of master's students and 83% of doctoral students never received a graduate school grade below B−, and about 50% of master's level and doctoral level students attained a GGPA of at least a 3.8.[3] Overall and for specific program areas, one can find intercorrelations among predictor variables (GRE Verbal Reasoning, GRE Quantitative Reasoning, GRE Analytical Writing, and UGPA) for applicants in Tables 13 and 14. Intercorrelations among the GRE sections generally are larger than they are between GRE sections and UGPA.

Meta-Analysis and Statistical Artifacts

We conducted meta-analyses on the data in several ways, partly based on Hunter and Schmidt's (2004) approach for correlation-based validity coefficients and partly based on other methods.[4] As estimations of relationships involving the

Table 5 Highest Educational Attainment of Either of an Applicant's Parents: Master's Seekers

General program	CIP code	# of schools per CIP code	*N*	Grade school % (*N*)	Some high school% (*N*)	High school diploma or equivalent% (*N*)	Business/ trade school % (*N*)	Some college % (*N*)	Associate degree % (*N*)	Bachelor's degree% (*N*)	Some graduate/ professional school % (*N*)	Graduate or professional degree% (*N*)
Agriculture & related sciences	01	2	194	0.5 (1)	1 (2)	3.1 (6)	2.6 (5)	11.9 (23)	7.7 (15)	27.3 (53)	3.1 (6)	42.8 (83)
Natural resources & conservation	03	7	163	0 (0)	1.2 (2)	11 (18)	4.3 (7)	9.2 (15)	5.5 (9)	25.2 (41)	5.5 (9)	38 (62)
Architecture & related services	04	6	559	0.7 (4)	2.3 (13)	8.9 (50)	5.5 (31)	10.2 (57)	4.8 (27)	25.4 (142)	7 (39)	35.1 (196)
Area, ethnic, cultural & gender studies	05	5	155	0.6 (1)	3.2 (5)	9 (14)	1.9 (3)	17.4 (27)	4.5 (7)	20 (31)	9.7 (15)	33.5 (52)
Communication, journalism, related programs	09	8	715	0.6 (4)	1.1 (8)	8.7 (62)	3.2 (23)	10.3 (74)	4.8 (34)	23.9 (171)	6.2 (44)	41.3 (295)
Computer & information services	11	8	262	1.5 (4)	6.1 (16)	10.7 (28)	1.1 (3)	8.8 (23)	5 (13)	30.9 (81)	6.1 (16)	29.8 (78)
Education	13	10	4,630	1.5 (69)	2.4 (109)	14.1 (655)	4.4 (205)	13.6 (629)	7.8 (362)	22.6 (1,045)	5.1 (237)	28.5 (1,319)
Engineering	14	7	1,450	2.3 (33)	2.9 (42)	10.3 (149)	3.5 (51)	10.1 (147)	5.9 (85)	27.9 (404)	5 (72)	32.2 (467)
Engineering tech. & engineering related fields	15	2	137	1.5 (2)	2.2 (3)	9.5 (13)	0.7 (1)	10.9 (15)	8 (11)	27 (37)	5.8 (8)	34.3 (47)
Foreign languages, literature, & linguistics	16	6	234	1.3 (3)	0.4 (1)	11.1 (26)	3.4 (8)	11.5 (27)	5.1 (12)	21.4 (50)	6.8 (16)	38.9 (91)
Family & consumer science/human science	19	2	87	0 (0)	1.1 (1)	10.3 (9)	2.3 (2)	16.1 (14)	8 (7)	20.7 (18)	4.6 (4)	36.8 (32)
English language & literature/letters	23	9	547	0.7 (4)	1.3 (7)	10.2 (56)	5.5 (30)	10.8 (59)	7.1 (39)	24.5 (134)	6.6 (36)	33.3 (182)
Liberal arts & science, general studies & humanities	24	6	118	0 (0)	2.5 (3)	11 (13)	5.1 (6)	13.6 (16)	5.1 (6)	22.9 (27)	6.8 (8)	33.1 (39)
Library science	25	2	866	1 (9)	3.6 (31)	16.2 (140)	6.2 (54)	14 (121)	5.8 (50)	21.7 (188)	4.3 (37)	27.3 (236)
Biological & biomedical sciences	26	9	440	1.4 (6)	0.7 (3)	7.7 (34)	3.4 (15)	12 (53)	9.3 (41)	22.7 (100)	5.7 (25)	37 (163)
Mathematics & statistics	27	8	227	1.8 (4)	2.2 (5)	11.9 (27)	3.1 (7)	10.1 (23)	8.4 (19)	26.4 (60)	4.4 (10)	31.7 (72)
Multi/interdisciplinary studies	30	4	73	0 (0)	0 (0)	16.4 (12)	5.5 (4)	9.6 (7)	4.1 (3)	17.8 (13)	6.8 (5)	39.7 (29)
Parks, recreation, leisure & fitness studies	31	6	375	0 (0)	0.5 (2)	8 (30)	2.1 (8)	10.4 (39)	8 (30)	28.3 (106)	5.1 (19)	37.6 (141)
Philosophy & religious studies	38	5	79	1.3 (1)	0 (0)	16.5 (13)	6.3 (5)	3.8 (3)	10.1 (8)	20.3 (16)	3.8 (3)	38 (30)
Physical sciences	40	7	237	0.8 (2)	0.4 (1)	9.7 (23)	3.4 (8)	10.5 (25)	7.2 (17)	24.5 (58)	6.3 (15)	37.1 (88)
Psychology	42	9	460	1.1 (5)	1.5 (7)	10.7 (49)	3.9 (18)	16.1 (74)	8.3 (38)	21.3 (98)	5 (23)	32.2 (148)
Security & protective services	43	7	467	0.9 (4)	2.4 (11)	16.5 (77)	3.4 (16)	17.8 (83)	10.5 (49)	22.9 (107)	4.1 (19)	21.6 (101)
Public admin. & social service professions	44	9	1,713	2.1 (36)	3.4 (59)	16.8 (288)	5.8 (100)	15 (257)	7.5 (129)	20.4 (349)	4.5 (77)	24.4 (418)
Social sciences	45	9	1,127	1 (11)	1.6 (18)	10.9 (123)	4.7 (53)	14.1 (159)	6.9 (78)	25.2 (284)	6.7 (76)	28.8 (325)
Visual & performing arts	50	6	741	0.5 (4)	1.6 (12)	6.9 (51)	2.7 (20)	9.7 (72)	5.3 (39)	24.3 (180)	5.8 (43)	43.2 (320)
Health professions & clinical services	51	10	3,745	0.9 (34)	2.5 (92)	12 (451)	4.9 (184)	13 (487)	9 (338)	24.3 (909)	5.1 (191)	28.3 (1,059)
Business, management & marketing	52	9	894	1 (9)	1.9 (17)	10.7 (96)	4.4 (39)	12.6 (113)	6.4 (57)	25.4 (227)	4.9 (44)	32.7 (292)
History	54	8	285	1.1 (3)	1.1 (3)	14.4 (41)	4.9 (14)	16.1 (46)	6.7 (19)	20.4 (58)	6 (17)	29.5 (84)
Overall (all general programs combined)		10	20,980	1.2 (253)	2.3 (473)	12.2 (2,554)	4.4 (920)	12.8 (2,688)	7.3 (1,542)	23.8 (4,987)	5.3 (1,114)	30.7 (6,449)

Note. CIP = classification of instructional programs.

Table 6 Highest Educational Attainment of Either of an Applicant's Parents: Doctorate Seekers

General program	CIP code	# of schools per CIP code	*N*	Grade school % (*N*)	Some high school% (*N*)	High school diploma or equivalent% (*N*)	Business/ trade school % (*N*)	Some college% (*N*)	Associate degree% (*N*)	Bachelor's degree% (*N*)	Some graduate/ professional school % (*N*)	Graduate or professional degree% (*N*)
Agriculture & related sciences	01	1	44	4.5 (2)	0 (0)	2.3 (1)	6.8 (3)	2.3 (1)	13.6 (6)	27.3 (12)	2.3 (1)	40.9 (18)
Natural resources & conservation	03	1	26	0 (0)	0 (0)	0 (0)	0 (0)	3.8 (1)	0 (0)	26.9 (7)	15.4 (4)	53.8 (14)
Architecture & related services	04	2	12	0 (0)	0 (0)	16.7 (2)	0 (0)	8.3 (1)	0 (0)	25 (3)	0 (0)	50 (6)
Communication, journalism, related programs	09	2	23	4.3 (1)	0 (0)	8.7 (2)	4.3 (1)	13 (3)	0 (0)	17.4 (4)	0 (0)	52.2 (12)
Computer & information services	11	4	94	1.1 (1)	1.1 (1)	12.8 (12)	2.1 (2)	8.5 (8)	5.3 (5)	26.6 (25)	8.5 (8)	34 (32)
Education	13	8	519	2.9 (15)	4.8 (25)	18.5 (96)	5.8 (30)	12.3 (64)	6.2 (32)	15.6 (81)	4 (21)	29.9 (155)
Engineering	14	6	644	3 (19)	3 (19)	7.9 (51)	2.5 (16)	8.7 (56)	5.4 (35)	24.7 (159)	5 (32)	39.9 (257)
Foreign languages, literature, & linguistics	16	3	50	8 (4)	2 (1)	14 (7)	6 (3)	10 (5)	8 (4)	10 (5)	8 (4)	34 (17)
Family & consumer sciences/human sciences	19	1	10	0 (0)	0 (0)	0 (0)	0 (0)	10 (1)	0 (0)	20 (2)	30 (3)	40 (4)
English language & literature/letters	23	4	134	0.7 (1)	3 (4)	13.4 (18)	3.7 (5)	14.9 (20)	4.5 (6)	20.9 (28)	5.2 (7)	33.6 (45)
Liberal arts & science, general studies & humanities	24	1	20	0 (0)	10 (2)	5 (1)	5 (1)	25 (5)	0 (0)	10 (2)	5 (1)	40 (8)
Library science	25	1	8	0 (0)	12.5 (1)	25 (2)	0 (0)	12.5 (1)	0 (0)	12.5 (1)	0 (0)	37.5 (3)
Biological & biomedical sciences	26	6	440	1.4 (6)	0.7 (3)	9.8 (43)	4.1 (18)	9.5 (42)	9.3 (41)	21.6 (95)	8 (35)	35.7 (157)
Mathematics & statistics	27	5	116	1.7 (2)	2.6 (3)	12.1 (14)	0.9 (1)	12.1 (14)	4.3 (5)	25.9 (30)	6 (7)	34.5 (40)
Multi/interdisciplinary studies	30	4	55	3.6 (2)	5.5 (3)	21.8 (12)	0 (0)	14.5 (8)	3.6 (2)	21.8 (12)	5.5 (3)	23.6 (13)
Parks, recreation, leisure & fitness studies	31	1	25	0 (0)	0 (0)	12 (3)	8 (2)	4 (1)	4 (1)	28 (7)	16 (4)	28 (7)
Philosophy & religious studies	38	3	101	0 (0)	0 (0)	8.9 (9)	3 (3)	13.9 (14)	6.9 (7)	19.8 (20)	13.9 (14)	33.7 (34)
Physical sciences	40	7	489	0.4 (2)	3.5 (17)	10.8 (53)	3.9 (19)	11.7 (57)	6.1 (30)	23.3 (114)	7.2 (35)	33.1 (162)
Psychology	42	6	411	0.5 (2)	1.2 (5)	8.3 (34)	2.7 (11)	11.7 (48)	3.9 (16)	23.6 (97)	7.1 (29)	41.1 (169)
Security & protective services	43	1	24	4.2 (1)	0 (0)	16.7 (4)	0 (0)	12.5 (3)	4.2 (1)	12.5 (3)	12.5 (3)	37.5 (9)
Public admin. & social service professions	44	5	65	4.6 (3)	6.2 (4)	13.8 (9)	6.2 (4)	16.9 (11)	9.2 (6)	16.9 (11)	3.1 (2)	23.1 (15)
Social sciences	45	5	315	1.3 (4)	2.9 (9)	9.8 (31)	4.8 (15)	11.1 (35)	5.7 (18)	22.5 (71)	5.4 (17)	36.5 (115)
Visual & performing arts	50	3	36	5.6 (2)	0 (0)	11.1 (4)	5.6 (2)	8.3 (3)	0 (0)	19.4 (7)	5.6 (2)	44.4 (16)
Health professions & clinical services	51	8	330	1.5 (5)	3.6 (12)	13.9 (46)	2.7 (9)	11.8 (39)	7 (23)	24.2 (80)	5.2 (17)	30 (99)
Business, management & marketing	52	4	15	0 (0)	0 (0)	13.3 (2)	0 (0)	0 (0)	13.3 (2)	6.7 (1)	13.3 (2)	53.3 (8)
History	54	3	87	0 (0)	1.1 (1)	6.9 (6)	2.3 (2)	12.6 (11)	8 (7)	32.2 (28)	5.7 (5)	31 (27)
Overall (all general programs combined)		10	4,093	1.8 (72)	2.7 (110)	11.3 (462)	3.6 (147)	11 (452)	6 (247)	22.1 (905)	6.3 (256)	35.2 (1, 442)

Note. CIP = classification of instructional programs.

Table 7 Degree Objective (at Time of Registration for GRE Examinations): Master's Seekers

General program	CIP code	# of schools per CIP code	*N*	Master's % (*N*)	Doctoral% (*N*)	Postdoctoral study % (*N*)	Intermediate (e.g., specialist) % (*N*)	Nondegree graduate study% (*N*)	Not currently planning graduate study % (*N*)
Agriculture & related sciences	01	2	195	73.9 (144)	24.6 (48)	1.5 (3)	0.0 (0)	0.0 (0)	0.0 (0)
Natural resources & conservation	03	7	164	65.9 (108)	31.1 (51)	2.4 (4)	0.6 (1)	0.0 (0)	0.0 (0)
Architecture & related services	04	6	566	89.9 (509)	9.7 (55)	0.2 (1)	0.0 (0)	0.2 (1)	0.0 (0)
Area, ethnic, cultural & gender studies	05	5	154	57.1 (88)	39.6 (61)	2.6 (4)	0.0 (0)	0.7 (1)	0.0 (0)
Communication, journalism, related programs	09	8	712	84.4 (601)	14.9 (106)	0.1 (1)	0.3 (2)	0.3 (2)	0.0 (0)
Computer & information services	11	8	266	82.0 (218)	17.7 (47)	0.0 (0)	0.4 (1)	0 (0)	0.0 (0)
Education	13	10	4,634	79.8 (3,697)	18.0 (835)	0.1 (6)	1.9 (90)	0.1 (5)	0.0 (1)
Engineering	14	7	1,462	80.7 (1,180)	18.5 (270)	0.3 (5)	0.2 (3)	0.1 (2)	0.1 (2)
Engineering tech. & engineering related fields	15	2	139	93.5 (130)	5.0 (7)	0.7 (1)	0.0 (0)	0 (0)	0.7 (1)
Foreign languages, literature, & linguistics	16	6	234	46.2 (108)	51.7 (121)	1.3 (3)	0.4 (1)	0.4 (1)	0.0 (0)
Family & consumer sciences/human sciences	19	2	87	78.2 (68)	21.8 (19)	0.0 (0)	0.0 (0)	0 (0)	0.0 (0)
English language & literature/letters	23	9	548	48.0 (263)	51.3 (281)	0.6 (3)	0.2 (1)	0 (0)	0.0 (0)
Liberal arts & science, general studies & humanities	24	6	119	58.0 (69)	40.3 (48)	0.8 (1)	0.8 (1)	0 (0)	0.0 (0)
Library science	25	2	865	87.3 (755)	10.8 (93)	0.6 (5)	1.2 (10)	0 (0)	0.2 (2)
Biological & biomedical sciences	26	9	440	49.6 (218)	44.3 (195)	5.5 (24)	0.2 (1)	0 (0)	0.5 (2)
Mathematics & statistics	27	8	228	61.8 (141)	35.5 (81)	1.3 (3)	0.0 (0)	0.9 (2)	0.4 (1)
Multi/interdisciplinary studies	30	4	74	63.5 (47)	35.1 (26)	0.0 (0)	1.4 (1)	0.0 (0)	0.0 (0)
Parks, recreation, leisure & fitness studies	31	6	373	82.0 (306)	17.4 (65)	0.0 (0)	0.3 (1)	0.0 (0)	0.3 (1)
Philosophy & religious studies	38	5	81	22.2 (18)	75.3 (61)	2.5 (2)	0.0 (0)	0.0 (0)	0.0 (0)
Physical sciences	40	7	237	51.9 (123)	44.3 (105)	3.4 (8)	0.0 (0)	0.0 (0)	0.4 (1)
Psychology	42	9	456	39.7 (181)	57.2 (261)	1.5 (7)	1.5 (7)	0.0 (0)	0.0 (0)
Security & protective services	43	7	468	71.4 (334)	27.8 (130)	0.6 (3)	0.2 (1)	0.0 (0)	0.0 (0)
Public administration & social service professions	44	9	1,710	84.4 (1,443)	14.0 (239)	0.4 (6)	1.2 (21)	0.1 (1)	0.0 (0)
Social sciences	45	9	1,127	56.3 (635)	42.2 (475)	1.3 (15)	0.1 (1)	0.1 (1)	0.0 (0)
Visual & performing arts	50	6	741	77.3 (573)	21.7 (161)	0.3 (2)	0.5 (4)	0.0 (0)	0.1 (1)
Health professions & clinical services	51	10	3,735	79.7 (2,977)	18.6 (693)	0.6 (23)	1.0 (36)	0.0 (1)	0.1 (5)
Business, management & marketing	52	9	890	80.8 (719)	18.1 (161)	0.7 (6)	0.3 (3)	0.0 (0)	0.1 (1)
History	54	8	286	33.6 (96)	65.7 (188)	0.4 (1)	0.0 (0)	0.0 (0)	0.4 (1)
Overall (all general programs combined)		10	20,991	75.0 (15,749)	23.3 (4,883)	0.7 (137)	0.9 (186)	0.1 (17)	0.1 (19)

Note. CIP = classification of instructional programs.

Table 8 Degree Objective (At Time of Registration for GRE Examinations): Doctorate Seekers

General program	CIP code	# of schools per CIP code	*N*	Master's % (*N*)	Doctoral % (*N*)	Postdoctoral study % (*N*)	Intermediate (e.g., specialist) % (*N*)	Nondegree graduate study % (*N*)	Not currently planning graduate study % (*N*)
Agriculture & related sciences	01	1	44	20.5 (9)	77.3 (34)	2.3 (1)	0.0 (0)	0.0 (0)	0.0 (0)
Natural resources & conservation	03	1	25	28.0 (7)	72.0 (18)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)
Architecture & related services	04	2	13	15.4 (2)	84.6 (11)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)
Communication, journalism, related programs	09	2	23	17.4 (4)	82.6 (19)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)
Computer & information services	11	4	93	23.7 (22)	76.3 (71)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)
Education	13	8	516	9.1 (47)	89.3 (461)	0.6 (3)	1.0 (5)	0.0 (0)	0.0 (0)
Engineering	14	6	647	23.5 (152)	74.8 (484)	1.6 (10)	0.0 (0)	0.0 (0)	0.2 (1)
Foreign languages, literature, & linguistics	16	3	50	4.0 (2)	94.0 (47)	2.0 (1)	0.0 (0)	0.0 (0)	0.0 (0)
Family & consumer sciences/human science	19	1	10	20.0 (2)	80.0 (8)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)
English language & literature/letters	23	4	136	4.4 (6)	94.9 (129)	0.7 (1)	0.0 (0)	0.0 (0)	0.0 (0)
Liberal arts & science, general studies & humanities	24	1	19	15.8 (3)	84.2 (16)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)
Library science	25	1	8	12.5 (1)	87.5 (7)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)
Biological & biomedical sciences	26	6	440	7.3 (32)	85.9 (378)	6.6 (29)	0.0 (0)	0.0 (0)	0.2 (1)
Mathematics & statistics	27	5	118	12.7 (15)	80.5 (95)	6.8 (8)	0.0 (0)	0.0 (0)	0.0 (0)
Multi/interdisciplinary studies	30	4	53	5.7 (3)	86.8 (46)	7.6 (4)	0.0 (0)	0.0 (0)	0.0 (0)
Parks, recreation, leisure & fitness studies	31	1	25	4.0 (1)	96.0 (24)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)
Philosophy & religious studies	38	3	103	0.0 (0)	97.1 (100)	2.9 (3)	0.0 (0)	0.0 (0)	0.0 (0)
Physical sciences	40	7	488	9.8 (48)	82.6 (403)	7.6 (37)	0.0 (0)	0.0 (0)	0.0 (0)
Psychology	42	6	413	2.4 (10)	94.2 (389)	2.4 (10)	1.0 (4)	0.0 (0)	0.0 (0)
Security & protective services	43	1	24	20.8 (5)	79.2 (19)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)
Public administration & social service professions	44	5	68	11.8 (8)	88.2 (60)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)
Social sciences	45	5	317	13.9 (44)	84.5 (268)	1.6 (5)	0.0 (0)	0.0 (0)	0.0 (0)
Visual & performing arts	50	3	36	16.7 (6)	83.3 (30)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)
Health professions & clinical services	51	8	333	21.3 (71)	76.6 (255)	0.9 (3)	1.2 (4)	0.0 (0)	0.0 (0)
Business, management & marketing	52	4	15	13.3 (2)	86.7 (13)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)
History	54	3	88	4.6 (4)	95.5 (84)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)
Overall (all general programs combined)		10	4,105	12.3 (506)	84.5 (3,469)	2.8 (115)	0.3 (13)	0.0 (0)	0.1 (2)

Note. CIP = classification of instructional programs.

Table 9 Descriptive Statistics for GRE Verbal Reasoning, Quantitative Reasoning, and Analytical Writing Sections: Master's Seekers

			GRE Verbal Reasoning					GRE Quantitative Reasoning				GRE Analytical Writing			
General program	CIP code	# of schools per CIP code	*N*	Min	Max	*M*	*SD*	Min	Max	*M*	*SD*	Min	Max	*M*	*SD*
Agriculture & related sciences	01	2	195	320	800	494	85	240	780	605	87	1.0	6.0	4.17	0.77
Natural resources & conservation	03	7	166	310	750	525	87	350	790	617	94	1.0	5.5	4.30	0.71
Architecture & related services	04	6	572	240	800	472	91	210	790	570	110	0.5	6.0	4.03	0.81
Area, ethnic, cultural & gender studies	05	5	157	300	720	517	87	200	790	551	117	2.5	6.0	4.50	0.80
Communication, journalism, related programs	09	8	729	270	800	480	84	200	800	537	110	0.5	6.0	4.25	0.80
Computer & information services	11	8	282	240	740	470	106	310	800	683	85	0.5	6.0	3.91	0.84
Education	13	10	4, 707	200	750	454	86	200	800	522	115	0.5	6.0	4.08	0.81
Engineering	14	7	1,503	200	770	471	87	200	800	692	77	0.5	6.0	3.99	0.79
Engineering tech. & engineering related fields	15	2	141	260	620	438	71	320	780	627	90	1.0	6.0	3.77	0.87
Foreign languages, literature, & linguistics	16	6	240	200	770	519	103	220	800	556	121	2.0	6.0	4.40	0.80
Family & consumer sciences/human sciences	19	2	87	290	680	451	80	290	710	528	95	2.0	6.0	3.91	0.78
English language & literature/letters	23	9	564	320	800	566	86	200	800	533	116	2.0	6.0	4.69	0.73
Liberal arts & science, general studies & humanities	24	6	122	200	740	504	110	200	790	503	136	2.0	6.0	4.27	0.84
Library science	25	2	879	220	800	526	106	200	800	528	123	1.5	6.0	4.23	0.78
Biological & biomedical sciences	26	9	447	230	800	506	92	310	790	623	89	2.0	6.0	4.27	0.80
Mathematics & statistics	27	8	232	270	760	482	102	470	800	727	60	1.0	6.0	4.06	0.83
Multi/interdisciplinary studies	30	4	76	270	710	481	87	310	790	590	108	2.0	6.0	4.33	0.86
Parks, recreation, leisure & fitness studies	31	6	379	230	680	448	74	200	800	579	92	1.5	6.0	4.07	0.74
Philosophy & religious studies	38	5	81	320	770	565	87	210	800	545	122	2.5	6.0	4.64	0.77
Physical sciences	40	7	242	280	700	489	80	340	800	658	79	1.0	6.0	4.16	0.81
Psychology	42	9	464	260	760	477	75	220	780	557	96	1.5	6.0	4.31	0.70
Security & protective services	43	7	473	230	710	451	82	200	800	506	112	2.0	6.0	4.02	0.79
Public administration & social service professions	44	9	1,735	210	800	436	87	200	800	464	121	0.5	6.0	3.94	0.83
Social sciences	45	9	1,139	250	780	497	87	200	800	559	110	1.5	6.0	4.32	0.81
Visual & performing arts	50	6	751	260	800	498	98	200	800	551	121	0.5	6.0	4.21	0.81
Health professions & clinical services	51	10	3,819	210	770	454	81	200	800	537	103	0.5	6.0	3.96	0.76
Business, management & marketing	52	9	910	210	780	470	89	200	800	585	112	0.5	6.0	4.06	0.82
History	54	8	289	290	800	549	81	200	800	553	107	0.5	6.0	4.60	0.78
Overall (all general programs combined)		10	21381	200	800	472	87	200	800	553	108	0.5	6.0	4.11	0.80

Note. CIP = classification of instructional programs; *M* = mean.

Table 10 Descriptive Statistics for GRE Verbal Reasoning, Quantitative Reasoning, and Analytical Writing Sections: Doctorate Seekers

			GRE Verbal Reasoning					GRE Quantitative Reasoning				GRE Analytical Writing			
General program	CIP code	# of schools per CIP code	*N*	Min	Max	*M*	*SD*	Min	Max	*M*	*SD*	Min	Max	*M*	*SD*
Agriculture & related sciences	01	1	46	310	770	480	95	420	760	620	90	3.0	6.0	4.20	0.71
Natural resources & conservation	03	1	26	350	800	585	99	430	780	673	91	3.5	6.0	4.94	0.71
Architecture & related services	04	2	13	380	700	551	64	380	680	551	94	3.0	5.5	4.65	0.88
Communication, journalism, related programs	09	2	23	420	660	564	58	370	750	611	96	3.0	6.0	4.63	0.90
Computer & information services	11	4	102	270	800	512	102	510	800	741	59	2.5	6.0	4.28	0.73
Education	13	8	539	270	770	491	92	200	800	542	121	0.5	6.0	4.33	0.83
Engineering	14	6	670	230	800	502	93	280	800	723	70	0.5	6.0	4.25	0.75
Foreign languages, literature, & linguistics	16	3	50	270	790	562	128	360	780	592	113	2.5	6.0	4.59	0.86
Family & consumer science/human sciences	19	1	12	230	640	473	113	440	770	606	115	2.5	5.0	4.00	0.85
English language & literature/letters	23	4	137	350	800	608	79	200	800	548	120	3.5	6.0	5.09	0.64
Liberal arts & science, general studies & humanities	24	1	20	290	740	560	118	270	750	496	132	2.5	6.0	4.35	1.10
Library science	25	1	9	340	660	537	131	410	750	600	113	2.5	5.0	3.89	1.02
Biological & biomedical sciences	26	6	446	280	800	532	88	320	800	654	83	2.0	6.0	4.41	0.76
Mathematics & statistics	27	5	122	250	780	499	107	560	800	751	53	2.0	6.0	4.23	0.72
Multi/interdisciplinary studies	30	4	56	340	750	533	92	350	770	597	94	2.5	6.0	4.47	0.76
Parks, recreation, leisure & fitness studies	31	1	25	340	650	486	64	380	800	633	99	2.5	6.0	4.66	0.80
Philosophy & religious studies	38	3	106	280	770	614	76	200	800	638	111	2.0	6.0	5.03	0.71
Physical sciences	40	7	508	240	800	489	96	290	800	690	79	0.5	6.0	4.16	0.83
Psychology	42	6	417	330	780	565	78	290	800	660	80	2.0	6.0	4.79	0.76
Security & protective services	43	1	26	330	750	513	106	340	800	567	108	2.5	6.0	4.60	0.98
Public administration & social service professions	44	5	70	280	720	517	109	250	800	577	112	2.5	6.0	4.30	0.86
Social sciences	45	5	326	260	760	538	97	220	800	630	95	2.0	6.0	4.70	0.80
Visual & performing arts	50	3	38	290	730	536	87	320	800	593	116	2.5	6.0	4.51	0.84
Health professions & clinical services	51	8	337	260	740	486	84	250	800	585	106	1.5	6.0	4.21	0.79
Business, management & marketing	52	4	16	360	700	566	60	470	800	686	99	3.0	6.0	4.56	0.62
History	54	3	89	320	780	590	89	340	790	595	106	3.0	6.0	4.99	0.74
Overall (all general programs combined)		10	4, 229	230	800	521	92	200	800	642	93	0.5	6.0	4.44	0.78

Note. CIP = classification of instructional programs; *M* = mean.

Table 11 Descriptive Statistics for Graduate Grade Point Average (GGPA) and Undergraduate Grade Point Average (UGPA): Master's Seekers

				Graduate GPA (GGPA)				Undergraduate GPA (UGPA)			
General program	CIP code	# of schools per CIP code	*N*	Min	Max	*M*	*SD*	Min	Max	*M*	*SD*
Agriculture & related sciences	01	2	195	2.67	4.00	3.70	0.27	.50	4.00	3.35	0.53
Natural resources & conservation	03	7	166	2.70	4.00	3.77	0.24	2.00	4.00	3.38	0.39
Architecture & related services	04	6	572	1.50	4.00	3.56	0.34	.40	4.00	3.29	0.40
Area, ethnic, cultural & gender studies	05	5	157	1.25	4.00	3.70	0.34	.40	4.00	3.45	0.46
Communication, journalism, related programs	09	8	729	0.00	4.00	3.62	0.33	.50	4.00	3.38	0.38
Computer & information services	11	8	282	0.00	4.00	3.52	0.44	2.24	4.00	3.32	0.41
Education	13	10	4,707	0.00	4.00	3.78	0.32	1.92	4.00	3.37	0.42
Engineering	14	7	1,503	1.00	4.00	3.56	0.37	2.00	4.00	3.31	0.40
Engineering tech. & engineering related fields	15	2	141	0.95	4.00	3.38	0.45	2.00	4.00	3.16	0.40
Foreign languages, literature, & linguistics	16	6	240	0.00	4.00	3.72	0.42	2.25	4.00	3.50	0.38
Family & consumer sciences/human sciences	19	2	87	1.50	4.00	3.72	0.40	2.50	4.00	3.46	0.30
English language & literature/letters	23	9	564	0.92	4.00	3.76	0.29	2.05	4.00	3.52	0.36
Liberal arts & science, general studies & humanities	24	6	122	0.00	4.00	3.57	0.55	2.00	4.00	3.40	0.46
Library science	25	2	879	0.00	4.00	3.72	0.45	1.59	4.00	3.33	0.45
Biological & biomedical sciences	26	9	447	1.21	4.00	3.65	0.34	.60	4.00	3.30	0.43
Mathematics & statistics	27	8	232	0.83	4.00	3.38	0.49	1.97	4.00	3.39	0.43
Multi/interdisciplinary studies	30	4	76	2.00	4.00	3.67	0.34	2.20	4.00	3.40	0.45
Parks, recreation, leisure & fitness studies	31	6	379	1.00	4.00	3.60	0.38	2.13	4.00	3.37	0.35
Philosophy & religious studies	38	5	81	1.50	4.00	3.65	0.38	2.14	4.00	3.57	0.38
Physical sciences	40	7	242	1.50	4.00	3.54	0.36	1.80	4.00	3.32	0.44
Psychology	42	9	464	1.23	4.00	3.74	0.25	1.97	4.00	3.53	0.32
Security & protective services	43	7	473	0.00	4.00	3.58	0.40	2.00	4.00	3.36	0.43
Public administration & social service professions	44	9	1,735	0.00	4.00	3.68	0.39	1.78	4.00	3.39	0.39
Social sciences	45	9	1,139	0.00	4.00	3.58	0.45	.36	4.00	3.38	0.41
Visual & performing arts	50	6	751	1.84	4.00	3.74	0.27	1.98	4.00	3.46	0.38
Health professions & clinical services	51	10	3,819	0.00	4.00	3.67	0.33	.40	4.00	3.36	0.49
Business, management & marketing	52	9	910	0.00	4.00	3.49	0.44	.40	4.00	3.28	0.52
History	54	8	289	0.00	4.00	3.66	0.35	2.20	4.00	3.53	0.36
Overall (all general programs combined)		10	21,381	0.00	4.00	3.67	0.36	.36	4.00	3.37	0.43

Note. CIP = classification of instructional programs; *M* = mean.

Table 12 Descriptive Statistics for Graduate Grade Point Average (GGPA) and Undergraduate Grade Point Average (UGPA): Doctorate Seekers

				Graduate GPA (GGPA)				Undergraduate GPA (UGPA)			
General program	CIP code	# of schools per CIP code	*N*	Min	Max	*M*	*SD*	Min	Max	*M*	*SD*
Agriculture & related sciences	01	1	46	1.32	4.00	3.66	0.43	2.50	4.00	3.34	0.38
Natural resources & conservation	03	1	26	3.39	4.00	3.92	0.13	2.00	4.00	3.42	0.44
Architecture & related services	04	2	13	3.42	3.92	3.71	0.16	2.20	3.85	3.25	0.50
Communication, journalism, related programs	09	2	23	3.57	4.00	3.83	0.12	2.40	4.00	3.49	0.43
Computer & information services	11	4	102	2.22	4.00	3.73	0.27	2.00	4.00	3.46	0.41
Education	13	8	539	1.71	4.00	3.81	0.23	1.77	4.00	3.54	0.42
Engineering	14	6	670	2.00	4.00	3.67	0.28	2.00	4.00	3.48	0.38
Foreign languages, literature, & linguistics	16	3	50	3.15	4.00	3.87	0.17	3.00	4.00	3.68	0.26
Family & consumer sciences/human sciences	19	1	12	3.23	4.00	3.66	0.24	3.25	3.94	3.68	0.24
English language & literature/letters	23	4	137	3.10	4.00	3.92	0.14	2.61	4.00	3.75	0.27
Liberal arts & sciences, general studies & humanities	24	1	20	3.52	4.00	3.82	0.12	2.24	4.00	3.45	0.47
Library science	25	1	9	3.49	4.00	3.85	0.15	2.92	3.93	3.54	0.36
Biological & biomedical sciences	26	6	446	2.00	4.00	3.70	0.29	0.50	4.00	3.45	0.42
Mathematics & statistics	27	5	122	1.55	4.00	3.54	0.40	2.36	4.00	3.52	0.40
Multi/interdisciplinary studies	30	4	56	2.82	4.00	3.74	0.21	2.50	4.00	3.55	0.38
Parks, recreation, leisure & fitness studies	31	1	25	3.44	4.00	3.83	0.19	0.50	4.00	3.44	0.71
Philosophy & religious studies	38	3	106	0.00	4.00	3.69	0.49	2.19	4.00	3.65	0.32
Physical sciences	40	7	508	0.90	4.00	3.52	0.42	2.00	4.00	3.38	0.38
Psychology	42	6	417	1.33	4.00	3.82	0.23	1.76	4.00	3.72	0.28
Security & protective services	43	1	26	3.08	4.00	3.63	0.27	2.47	4.00	3.63	0.38
Public administration & social service professions	44	5	70	1.71	4.00	3.75	0.33	2.06	4.00	3.58	0.44
Social sciences	45	5	326	1.73	4.00	3.73	0.30	2.33	4.00	3.61	0.34
Visual & performing arts	50	3	38	3.43	4.00	3.84	0.13	3.29	4.00	3.77	0.24
Health professions & clinical services	51	8	337	0.00	4.00	3.68	0.39	2.30	4.00	3.56	0.36
Business, management & marketing	52	4	16	3.05	4.00	3.73	0.26	2.39	4.00	3.51	0.45
History	54	3	89	2.61	4.00	3.82	0.22	2.45	4.00	3.65	0.33
Overall (all general programs combined)		10	4, 229	0.00	4.00	3.71	0.31	0.50	4.00	3.54	0.37

Note. CIP = classification of instructional programs; *M* = mean.

Table 13 Intercorrelations Between Independent Variables: Master's-Seeking Applicants

General program	CIP code	*N*	# of schools per CIP code	$r_{GRE\text{-}V,GRE\text{-}Q}$	$r_{GRE\text{-}V,GRE\text{-}AW}$	$r_{GRE\text{-}Q,GRE\text{-}AW}$	$r_{GRE\text{-}V,UGPA}$	$r_{GRE\text{-}Q,UGPA}$	$r_{GRE\text{-}AW,UGPA}$
Agriculture & related science	01	1,076	2	0.47	0.45	0.36	0.16	0.11	0.22
Natural resources & conservation	03	844	7	0.47	0.37	0.30	0.21	0.25	0.18
Architecture & related services	04	2,259	6	0.43	0.48	0.31	0.18	0.14	0.15
Area, ethnic, cultural & gender studies	05	641	5	0.44	0.54	0.35	0.25	0.18	0.20
Communication, journalism, related programs	09	3,003	8	0.42	0.43	0.22	0.16	0.20	0.18
Computer & information sciences	11	3,217	8	0.22	0.53	0.16	0.10	0.15	0.14
Education	13	18,480	10	0.46	0.47	0.33	0.13	0.13	0.14
Engineering	14	16,193	7	0.27	0.51	0.20	0.12	0.19	0.14
Engineering technology & engineering related fields	15	526	2	0.17	0.45	0.25	0.06	0.21	0.14
Foreign languages, literature & linguistics	16	1,128	6	0.55	0.55	0.39	0.20	0.18	0.18
Family & consumer sciences/human sciences	19	357	2	0.43	0.36	0.15	0.27	0.34	0.14
English language & literature/letters	23	3,981	9	0.45	0.38	0.30	0.23	0.18	0.24
Liberal arts & sciences, general studies & humanities	24	2,132	6	0.47	0.49	0.32	0.18	0.13	0.16
Library science	25	2,076	2	0.46	0.49	0.34	0.13	0.14	0.22
Biological & biomedical science	26	4,728	9	0.35	0.44	0.24	0.20	0.21	0.19
Mathematics & statistics	27	2,091	8	0.29	0.52	0.18	0.17	0.19	0.18
Multi/interdisciplinary studies	30	552	4	0.40	0.38	0.32	0.16	0.16	0.20
Parks, recreation, leisure & fitness studies	31	1,864	6	0.39	0.42	0.23	0.14	0.18	0.18
Philosophy & religious studies	38	773	5	0.40	0.35	0.29	0.23	0.19	0.15
Physical sciences	40	4,073	7	0.33	0.50	0.23	0.13	0.18	0.16
Psychology	42	8,754	9	0.52	0.43	0.37	0.22	0.21	0.20
Security & protective services	43	1,981	7	0.50	0.46	0.36	0.14	0.12	0.19
Public administration & social service professionals	44	5,030	9	0.53	0.49	0.39	0.22	0.14	0.21
Social sciences	45	6,596	9	0.38	0.45	0.26	0.18	0.16	0.22
Visual & performing arts	50	3,131	6	0.44	0.50	0.34	0.14	0.12	0.18
Health professions & clinical services	51	21,653	10	0.45	0.42	0.33	0.12	0.11	0.12
Business, management, marketing	52	4,272	9	0.40	0.45	0.22	0.12	0.13	0.15
History	54	1,271	8	0.44	0.33	0.25	0.21	0.12	0.18
Overall (all general programs combined)		122,682	10	0.42	0.46	0.30	0.15	0.15	0.17

Note. CIP = classification of instructional programs; GRE-V = GRE Verbal Reasoning; GRE-Q = GRE Quantitative Reasoning; GRE-AW = GRE Analytical Writing; UGPA = undergraduate grade point average

Table 14 Intercorrelations Between Independent Variables: Doctorate-Seeking Applicants

General program	CIP code	*N*	# of schools per CIP code	$r_{GRE\text{-}V,GRE\text{-}Q}$	$r_{GRE\text{-}V,GRE\text{-}AW}$	$r_{GRE\text{-}Q,GRE\text{-}AW}$	$r_{GRE\text{-}V,UGPA}$	$r_{GRE\text{-}Q,UGPA}$	$r_{GRE\text{-}AW,UGPA}$
Agriculture & related science	01	1,076	1	0.48	0.48	0.39	0.12	0.16	0.23
Natural resources & conservation	03	844	1	0.54	0.36	0.39	0.18	0.19	0.14
Architecture & related services	04	2,259	2	0.40	0.48	0.26	0.27	0.24	0.20
Communication, journalism, related programs	09	3,003	2	0.41	0.47	0.18	0.23	0.22	0.22
Computer & information science	11	3,217	4	0.20	0.54	0.14	0.10	0.12	0.15
Education	13	18,480	8	0.46	0.48	0.32	0.16	0.16	0.16
Engineering	14	16,193	6	0.28	0.52	0.22	0.14	0.20	0.15
Foreign languages, literature & linguistics	16	1,128	3	0.59	0.51	0.42	0.20	0.22	0.18
Family & consumer sciences/human sciences	19	357	1	0.39	0.37	0.08	0.25	0.34	0.12
English language & literature/letters	23	3,981	4	0.44	0.39	0.27	0.24	0.17	0.25
Liberal arts & science, general studies & humanities	24	2,132	1	0.34	0.60	0.33	0.19	0.22	0.39
Library science	25	2,076	1	0.42	0.54	0.32	0.22	0.29	0.26
Biological & biomedical sciences	26	4,728	6	0.35	0.43	0.24	0.21	0.21	0.20
Mathematics & statistics	27	2,091	5	0.28	0.51	0.16	0.17	0.20	0.18
Multi/interdisciplinary studies	30	552	4	0.40	0.40	0.29	0.11	0.09	0.20
Parks, recreation, leisure & fitness studies	31	1,864	1	0.45	0.46	0.29	0.15	0.19	0.18
Philosophy & religious studies	38	773	3	0.44	0.33	0.30	0.23	0.13	0.15
Physical sciences	40	4,073	7	0.34	0.47	0.21	0.13	0.18	0.14
Psychology	42	8,754	6	0.54	0.44	0.37	0.25	0.22	0.20
Security & protective services	43	1,981	1	0.46	0.48	0.36	0.13	0.13	0.23
Public administration & social service professions	44	5,030	5	0.52	0.53	0.39	0.27	0.19	0.26
Social sciences	45	6,596	5	0.36	0.46	0.24	0.21	0.20	0.23
Visual & performing arts	50	3,131	3	0.42	0.51	0.35	0.15	0.15	0.15
Health professions & clinical science	51	21,653	8	0.48	0.45	0.34	0.13	0.13	0.14
Business, management, marketing	52	4,272	4	N/A	N/A	N/A	N/A	N/A	N/A
History	54	1,271	3	0.48	0.39	0.28	0.20	0.15	0.21
Overall (all general programs combined)		121,515	10	0.42	0.47	0.30	0.18	0.18	0.18

Note. CIP = classification of instructional programs; GRE-V = GRE Verbal Reasoning; GRE-Q = GRE Quantitative Reasoning; GRE-AW = GRE Analytical Writing; UGPA = undergraduate grade point average.

measurement of latent characteristics for a population of interest, all statistics are vulnerable to statistical artifacts that make their interpretation more difficult. In this study, the statistical artifacts addressed were sampling error, range variation, and unreliability in the criterion variable (GGPA) only.

Sampling Error and Aggregation Decisions

Sampling error occurs when the data available for analysis (e.g., data for just the graduating class of 2010) are for just a sample (subset) from a larger population (e.g., all students) about which the researcher wishes to answer a research question (e.g., "What is the relationship between admission test scores and future grade point average for all students?"). Due to various causes, samples never perfectly represent the larger populations from which they come. Sampling error causes data to randomly misrepresent the population about which a researcher wishes to draw conclusions. One addresses this issue by increasing sample size to increase the probability that the sample represents the population sufficiently well. In this study, sampling error was addressed by aggregating, separately for doctoral versus master's level programs, all data based on two-digit CIP codes within each of the 10 institutions (NCES, 2012). In this particular study, aggregation using CIP codes helps us to more authoritatively say what the validity of the GRE sections are for the domains defined by these codes. This data aggregation procedure consisted of computing validity metrics (zero-order correlations, multiple correlations, incremental coefficients of determination, usefulness weights, and quartile comparisons) and criterion unreliability for each two-digit CIP code for each degree level of the 10 universities. Validity metrics were adjusted for range variation (and values necessary to make that adjustment were calculated) for each two-digit CIP code for each degree level of the 10 universities. This is equivalent to treating each two-digit CIP code at each degree level within each university as if it were its own study. After computing each metric (and after making any adjustments), they were averaged within degree level and across universities after weighting by sample size. Ultimately, these averages are reported for each two-digit CIP code for each degree level (see the appendix). As a result of this aggregation approach, these averages can at least attempt to properly account for unique aspects of each degree level within university (e.g., differences in graduate grading stringency across universities within degree levels).

The approach of examining predictor-criterion relationships for master's programs separately from doctoral programs is consistent with methodology that Kuncel et al. (2010) and Burton and Wang (2005) pursued. This method was followed in the belief that between these two levels of degree programs there might be practically significant differences in (a) the knowledge, skills, abilities, and other relevant characteristics (KSAOs) of their respective populations, as well as (b) the determinants of success (e.g., ability, motivation, etc.). Kuncel et al. (2010) found some differences in both adjusted and unadjusted validity coefficients between master's and doctoral programs. Even though many of these differences were relatively small, the current analyses go further than Kuncel et al. (2010), by looking at validity metrics beyond zero-order coefficients and subpopulations at the program area level.

There were 28 master's level program areas and 26 doctoral level program areas for which data were available and definable by two-digit CIP codes. For each degree level, some program areas had small sample sizes, as defined by the small number of students (N) and the small number of universities (k) that contributed data. Consequently, our discussion of results (presented here) is limited to a subset of these program areas. This subset, consisting of eight program areas, includes education; engineering; English language and literature/letters; biological and biomedical sciences; mathematics and statistics; psychology; health professions and clinical sciences; and business, management, and marketing. For business, management, and marketing, we excluded results for doctoral programs, because there were only 16 enrolled doctoral students in total across four universities. These eight program areas were chosen based on their large sample sizes and their ability to represent a wide range of domains, including STEM, social science, humanities, and applied professional fields. In Tables 15–22, a prominent separation was placed between applied professional fields, namely health professions and clinical sciences as well as business, management, and marketing, from the other fields because the history of using the GRE for admissions in applied professional fields is much shorter than that for admissions in other areas. Only students in the applied professional fields who were seeking either a master's or doctoral degree were included in the data (e.g., anyone seeking an M.D. degree was removed), because it was assumed that the presence of a GRE score for a student seeking any other degree was coincidental and did not indicate that the GRE test was being used to make an admissions decision for that student for the program for which the student's graduate school grades were available.

Table 15 Zero-Order Correlations Between Cumulative Graduate Grade Point Average (GGPA) and GRE Sections Overall and for Eight Program Areas: Master's Seekers

			General program area (with its 2-digit CIP code)							
		Overall	Education (13)	Engineering (14)	English language & literature/ letters (23)	Biological & biomedical science (26)	Mathematics & statistics (27)	Psychology (42)	Health professions & clinical science (51)	Business, management, marketing (52)
N		21,127	4,649	1,481	552	445	230	461	3,772	901
k		10	10	7	9	9	8	9	10	9
Attenuation of ρ_{XY} due to unreliability of criterion (GGPA)	Cronbach's alpha	0.72	0.70	0.76	0.69	0.64	0.71	0.69	0.76	0.71
	Reduction in magnitude of ρ_{XY}	−15%	−17%	−13%	−17%	−20%	−16%	−17%	−13%	−16%
GRE Verbal Reasoning	Mean U_{RR}	1.12	1.08	1.26	1.16	1.10	1.14	1.24	1.09	1.14
	r_{obs}	0.15	0.12	0.10	0.26	0.13	0.06	0.07	0.18	0.11
	r_{urv}	0.16	0.13	0.12	0.29	0.13	0.06	0.09	0.19	0.13
	r_{mrv}	0.16	0.13	0.12	0.30	0.18	0.05	0.08	0.20	0.13
	$r_{mrv+UGPA}$	0.17	0.15	0.14	0.32	0.20	0.12	0.09	0.22	0.14
GRE Quantitative Reasoning	Mean U_{RR}	1.14	1.10	1.06	1.07	1.16	1.38	1.24	1.18	1.17
	r_{obs}	0.13	0.09	0.13	0.17	0.19	0.16	0.09	0.15	0.11
	r_{urv}	0.15	0.10	0.13	0.18	0.22	0.22	0.11	0.17	0.13
	r_{mrv}	0.14	0.10	0.14	0.15	0.17	0.25	−0.02	0.18	0.13
	$r_{mrv+UGPA}$	0.15	0.12	0.14	0.16	0.15	0.21	−0.01	0.21	0.15
GRE Analytical Writing	Mean U_{RR}	1.05	1.04	1.04	1.06	1.06	1.07	1.18	1.04	1.05
	r_{obs}	0.16	0.14	0.14	0.28	0.15	0.11	0.19	0.16	0.11
	r_{urv}	0.17	0.15	0.15	0.29	0.15	0.12	0.22	0.16	0.12
	r_{mrv}	0.19	0.15	0.15	0.33	0.19	0.08	0.31	0.18	0.13
	$r_{mrv+UGPA}$	0.19	0.16	0.16	0.33	0.20	0.17	0.23	0.20	0.15

Note. CIP = classification of instructional programs; ρ_{XY} = true score validity for applicant pool (no statistical artifacts); Mean U_{RR} = mean of the applicant standard deviation divided by the enrollee standard deviation (sample-size weighted by 2-digit CIP codes across universities); r_{obs} = correlation based on observed data after aggregation within 2-digit CIP codes within each university and then sample-size weighted aggregation across universities; $r_{urv} = r_{obs}$ adjusted for univariate range variation; $r_{mrv} = r_{obs}$ adjusted for multivariate range variation (variance-covariance matrix used in adjustment includes all GRE sections but excludes undergraduate grade point average); $r_{mrv+UGPA} = r_{obs}$ adjusted for multivariate range variation (variance-covariance matrix used in adjustment includes all GRE sections and undergraduate grade point average).

Table 16 Multivariate Analyses of Variables' Importance Based on Observed Data (No Adjustments for Range Variation): Master's Seekers

			General program area (with its 2-digit CIP code)							
		Overall	Education (13)	Engineering (14)	English language & literature/ letters (23)	Biological & biomedical science (26)	Mathematics & statistics (27)	Psychology (42)	Health professions & clinical science (51)	Business, management, marketing (52)
N		21,127	4,649	1,481	552	445	230	461	3,772	901
k		10	10	7	9	9	8	9	10	9
Model R (R^2)	R (R^2)	0.27 (0.07)	0.19 (0.04)	0.21 (0.04)	0.37 (0.14)	0.33 (0.11)	0.35 (0.12)	0.35 (0.12)	0.24 (0.06)	0.23 (0.05)
	R_{+UGPA} (R^2_{+UGPA})	0.36 (0.13)	0.30 (0.09)	0.34 (0.12)	0.43 (0.19)	0.42 (0.18)	0.48 (0.23)	0.43 (0.19)	0.35 (0.12)	0.32 (0.10)
ΔR^2 over UGPA	GRE V + Q + AW	0.07	0.03	0.03	0.13	0.10	0.15	0.14	0.06	0.06
	GRE Verbal Reasoning	0.03	0.01	0.01	0.07	0.04	0.05	0.02	0.03	0.02
	GRE Quantitative Reasoning	0.02	0.01	0.01	0.02	0.04	0.05	0.06	0.03	0.02
	GRE Analytical Writing	0.03	0.02	0.01	0.07	0.03	0.03	0.05	0.02	0.02
GRE Verbal Reasoning	β	0.07	0.06	0.02	0.17	−0.01	−0.03	0.02	0.11	0.06
	β_{+UGPA}	0.07	0.07	0.03	0.17	−0.02	0.04	0.05	0.10	0.06
	$\%C_{xj}$	30%	28%	20%	37%	31%	27%	15%	41%	28%
	$\%C_{xj+UGPA}$	14%	12%	7%	30%	18%	13%	11%	18%	18%
GRE Quantitative Reasoning	β	0.08	0.03	0.10	0.02	0.21	0.30	0.02	0.08	0.07
	β_{+UGPA}	0.06	0.02	0.05	0.01	0.18	−0.02	0.00	0.09	0.06
	$\%C_{xj}$	28%	21%	36%	14%	41%	40%	37%	28%	37%
	$\%C_{xj+UGPA}$	14%	9%	14%	9%	18%	15%	26%	17%	16%
GRE Analytical Writing	β	0.12	0.11	0.11	0.22	0.12	−0.07	0.20	0.10	0.09
	β_{+UGPA}	0.10	0.08	0.08	0.19	0.09	0.12	0.20	0.09	0.07
	$\%C_{xj}$	40%	47%	43%	47%	27%	31%	47%	29%	33%
	$\%C_{xj+UGPA}$	16%	13%	11%	29%	15%	16%	25%	13%	16%
UGPA	β	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	β_{+UGPA}	0.23	0.23	0.27	0.18	0.24	0.34	0.20	0.24	0.20
	$\%C_{xj}$	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	$\%C_{xj+UGPA}$	53%	64%	67%	29%	46%	56%	37%	50%	48%

Note. All GRE sections were included in calculating tabled values; Model R (R^2) and GRE V (Verbal) + Q (Quantitative) + AW (Analytical Writing) are based on GRE sections optimally weighted and then added together in an ordinary least squares regression model; CIP = Classification of Instructional Programs; UGPA = undergraduate grade point average; R^2 = proportion of variability in the criterion (graduate GPA) predicted; ΔR^2 over UGPA = amount of variability of the criterion predicted by GRE sections over and above what UGPA alone predicts; the subscript $_{+UGPA}$ indicates that the UGPA variable was included when calculating values; $\%C_{xj}$ = usefulness (general dominance) weight converted into the percentage of the R^2 attributable to a variable.

Table 17 Multivariate Analyses of Variables' Importance Based on Observed Data (Adjusted for Multivariate Range Variation): Master's Seekers

			General program area (with its 2-digit CIP code)							
		Overall	Education (13)	Engineering (14)	English language & literature/ letters (23)	Biological & biomedical science (26)	Mathematics & statistics (27)	Psychology (42)	Health professions & clinical science (51)	Business, management, marketing (52)
N		21,127	4,649	1,481	552	445	230	461	3,772	901
k		10	10	7	9	9	8	9	10	9
Model R (R^2)	R (R^2)	0.33 (0.11)	0.20 (0.04)	0.22 (0.05)	0.41 (0.17)	0.36 (0.13)	0.42 (0.18)	0.55 (0.30)	0.28 (0.08)	0.25 (0.06)
	R_{+UGPA} (R^2_{+UGPA})	0.43 (0.19)	0.32 (0.10)	0.37 (0.14)	0.47 (0.22)	0.45 (0.21)	0.55 (0.30)	0.65 (0.43)	0.40 (0.16)	0.37 (0.13)
ΔR^2 over UGPA	GRE V + Q + AW	0.06	0.03	0.03	0.12	0.09	0.13	0.13	0.06	0.05
	GRE Verbal Reasoning	0.03	0.02	0.01	0.07	0.03	0.03	0.03	0.04	0.02
	GRE Quantitative Reasoning	0.03	0.01	0.02	0.02	0.04	0.06	0.07	0.04	0.02
	GRE Analytical Writing	0.03	0.02	0.01	0.07	0.04	0.03	0.07	0.03	0.02
GRE Verbal Reasoning	$\%C_{xj}$	29%	23%	21%	40%	32%	22%	16%	40%	32%
	$\%C_{xj+UGPA}$	14%	11%	8%	31%	18%	12%	13%	16%	21%
GRE Quantitative Reasoning	$\%C_{xj}$	31%	24%	39%	10%	42%	47%	35%	34%	37%
	$\%C_{xj+UGPA}$	14%	8%	13%	7%	18%	21%	22%	17%	15%
GRE Analytical Writing	$\%C_{xj}$	41%	54%	40%	50%	26%	31%	48%	26%	31%
	$\%C_{xj+UGPA}$	17%	13%	10%	30%	16%	17%	23%	12%	17%
UGPA	$\%C_{xj}$	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	$\%C_{xj+UGPA}$	56%	67%	69%	32%	48%	51%	41%	55%	47%

Note. All GRE sections were included in calculating tabled values; Model R (R^2) and GRE V (Verbal) + Q (Quantitative) + AW (Analytical Writing) are based on GRE sections optimally weighted and then added together in an ordinary least squares regression model; CIP = Classification of Instructional Programs; UGPA = undergraduate grade point average; R^2 = proportion of variability in the criterion (graduate GPA) predicted; ΔR^2 over UGPA = amount of variability of the criterion predicted by GRE sections over and above what UGPA alone predicts; the subscript $_{+UGPA}$ indicates that the UGPA variable was included when calculating values; $\%C_{xj}$ = usefulness (general dominance) weight converted into the percentage of the R^2 attributable to a variable.

Table 18 GRE Quartile Comparisons: Master's Seekers

			General program area (with its 2-digit CIP code)							
		Overall	Education (13)	Engineering (14)	English language & literature/ letters (23)	Biological & biomedical science (26)	Mathematics & statistics (27)	Psychology (42)	Health professions & clinical science (51)	Business, management, marketing (52)
N		21,127	4,649	1,481	552	445	230	461	3,772	901
k		10	10	7	9	9	8	9	10	9
		Probability of grade of C+ or lower:								
GRE Verbal Reasoning	Low quartile	25%	17%	33%	12%	22%	45%	12%	30%	43%
	High quartile	16%	12%	30%	6%	13%	31%	6%	17%	31%
	Low/high	1.57	1.40	1.11	2.18	1.70	1.43	2.05	1.76	1.39
GRE Quantitative Reasoning	Low quartile	25%	17%	36%	10%	30%	49%	11%	28%	42%
	High quartile	17%	14%	25%	4%	8%	31%	6%	19%	33%
	Low/high	1.50	1.23	1.43	2.36	3.61	1.57	1.71	1.45	1.28
GRE Analytical Writing	Low quartile	26%	18%	40%	11%	29%	47%	17%	30%	45%
	High quartile	16%	11%	25%	4%	20%	38%	5%	18%	33%
	Low/high	1.65	1.57	1.57	2.76	1.49	1.22	3.47	1.68	1.37
		Probability of cumulative graduate GPA $\geq$ 3.8:								
GRE Verbal Reasoning	High quartile	58%	76%	37%	74%	57%	21%	62%	57%	27%
	Low quartile	36%	54%	27%	49%	31%	14%	48%	33%	13%
	High/low	1.62	1.41	1.35	1.51	1.84	1.53	1.28	1.71	2.09
GRE Quantitative Reasoning	High quartile	55%	71%	37%	77%	55%	29%	56%	55%	25%
	Low quartile	38%	55%	25%	55%	28%	7%	54%	36%	19%
	High/low	1.45	1.29	1.46	1.42	1.95	4.22	1.03	1.54	1.32
GRE Analytical Writing	High quartile	58%	76%	39%	75%	48%	23%	59%	54%	29%
	Low quartile	36%	55%	23%	42%	25%	18%	45%	36%	17%
	High/low	1.59	1.39	1.70	1.79	1.89	1.27	1.31	1.52	1.73

Note. CIP = classification of instructional programs; low quartile = lowest 25% of GRE scores; high quartile = highest 25% of GRE scores; low/high = low quartile divided by high quartile (how many times more likely a student in the lowest quartile would receive a grade of C+ in comparison to a student in the highest quartile); high/low = high quartile divided by low quartile (how many times more likely a student in the highest quartile would receive a cumulative graduate grade point average of at least 3.8 in comparison to a student in the lowest quartile).

Table 19 Zero-Order Correlations Between Cumulative Graduate Grade Point Average (GGPA) and GRE Sections Overall and for Seven Program Areas: Doctorate Seekers

			General program area (with its 2-digit CIP code)						
		Overall	Education (13)	Engineering (14)	English language & literature/ letters (23)	Biological & biomedical science (26)	Mathematics & statistics (27)	Psychology (42)	Health professions & clinical science (51)
N		4,229	539	670	137	446	122	417	337
k		10	8	6	4	6	5	6	8
Attenuation of ρ_{XY} due to unreliability of criterion (GGPA)	Cronbach's alpha	0.66	0.65	0.62	0.59	0.61	0.57	0.65	0.71
	Reduction in magnitude of ρ_{XY}	−19%	−20%	−21%	−24%	−22%	−24%	−19%	−16%
GRE Verbal Reasoning	Mean U_{RR}	1.14	1.04	1.22	1.23	1.17	1.09	1.22	1.09
	r_{obs}	0.13	0.18	0.04	0.01	0.24	0.03	0.17	0.10
	r_{urv}	0.15	0.18	0.05	0.00	0.28	0.02	0.21	0.12
	r_{mrv}	0.16	0.21	0.04	0.03	0.27	0.19	0.24	0.12
	$r_{mrv+UGPA}$	0.19	0.23	0.08	0.09	0.30	0.20	0.27	0.15
GRE Quantitative Reasoning	Mean U_{RR}	1.21	1.06	1.10	1.04	1.22	1.48	1.46	1.16
	r_{obs}	0.15	0.19	0.14	0.06	0.16	0.29	0.24	0.18
	r_{urv}	0.17	0.20	0.15	0.05	0.19	0.39	0.31	0.20
	r_{mrv}	0.20	0.29	0.21	0.07	0.20	0.40	0.32	0.22
	$r_{mrv+UGPA}$	0.24	0.30	0.24	0.10	0.22	0.41	0.39	0.24
GRE Analytical Writing	Mean U_{RR}	1.09	1.03	1.09	1.20	1.12	1.27	1.04	1.02
	r_{obs}	0.16	0.15	0.06	0.07	0.23	0.02	0.24	0.17
	r_{urv}	0.16	0.15	0.06	0.07	0.26	0.05	0.25	0.17
	r_{mrv}	0.17	0.17	0.07	0.01	0.27	0.15	0.28	0.20
	$r_{mrv+UGPA}$	0.21	0.19	0.10	0.11	0.27	0.18	0.32	0.23

Note. CIP = classification of instructional programs; ρ_{XY} = true score validity for applicant pool (no statistical artifacts); Mean U_{RR} = mean of the applicant standard deviation divided by the enrollee standard deviation (sample-size weighted by 2-digit CIP codes across universities); r_{obs} = correlation based on observed data after aggregation within 2-digit CIP codes within each university and then sample-size weighted aggregation across universities; $r_{urv} = r_{obs}$ adjusted for univariate range variation; $r_{mrv} = r_{obs}$ adjusted for multivariate range variation (variance-covariance matrix used in adjustment includes all GRE sections but excludes undergraduate grade point average); $r_{mrv+UGPA} = r_{obs}$ adjusted for multivariate range variation (variance-covariance matrix used in adjustment includes all GRE sections and undergraduate grade point average).

Table 20 Multivariate Analyses of Variables' Importance Based on Observed Data (No Adjustments for Range Variation): Doctorate Seekers

			General program area (with its 2-digit CIP code)						
		Overall	Education (13)	Engineering (14)	English language & literature/ letters (23)	Biological & biomedical science (26)	Mathematics & statistics (27)	Psychology (42)	Health professions & clinical science (51)
N		4,229	539	670	137	446	122	417	337
k		10	8	6	4	6	5	6	8
Model R (R^2)	R (R^2)	0.37 (0.13)	0.33 (0.11)	0.26 (0.07)	0.37 (0.14)	0.35 (0.12)	0.41 (0.17)	0.37 (0.14)	0.40 (0.16)
	R_{+UGPA} (R^2_{+UGPA})	0.46 (0.21)	0.37 (0.14)	0.44 (0.20)	0.48 (0.23)	0.41 (0.17)	0.51 (0.26)	0.53 (0.28)	0.45 (0.20)
ΔR^2 over UGPA	GRE V + Q + AW	0.15	0.12	0.07	0.21	0.10	0.23	0.13	0.17
	GRE Verbal Reasoning	0.05	0.06	0.01	0.06	0.05	0.04	0.02	0.05
	GRE Quantitative Reasoning	0.05	0.05	0.03	0.04	0.03	0.10	0.07	0.09
	GRE Analytical Writing	0.05	0.04	0.01	0.09	0.05	0.05	0.05	0.04
GRE Verbal	β	0.06	0.10	−0.03	−0.02	0.16	0.04	0.02	−0.02
Reasoning	β_{+UGPA}	0.04	0.10	−0.01	−0.01	0.16	0.01	−0.04	−0.03
	$\%C_{xj}$	30%	24%	32%	33%	36%	25%	18%	32%
	$\%C_{xj+UGPA}$	17%	21%	6%	17%	25%	15%	6%	22%
GRE Quantitative	β	0.12	0.17	0.15	0.08	0.09	0.28	0.20	0.17
Reasoning	β_{+UGPA}	0.11	0.17	0.09	0.07	0.07	0.25	0.22	0.14
	$\%C_{xj}$	34%	40%	38%	19%	20%	60%	41%	45%
	$\%C_{xj+UGPA}$	21%	24%	20%	13%	13%	39%	22%	25%
GRE Analytical	β	0.11	0.07	0.06	0.05	0.16	0.00	0.19	0.15
Writing	β_{+UGPA}	0.11	0.07	0.03	0.07	0.12	0.01	0.17	0.14
	$\%C_{xj}$	35%	35%	28%	47%	41%	14%	38%	22%
	$\%C_{xj+UGPA}$	21%	31%	4%	36%	24%	11%	18%	16%
UGPA	β	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	β_{+UGPA}	0.22	0.13	0.35	0.12	0.21	0.19	0.36	0.18
	$\%C_{xj}$	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	$\%C_{xj+UGPA}$	40%	23%	69%	33%	35%	36%	52%	36%

Note. All GRE sections were included in calculating tabled values; Model R (R^2) and GRE V (Verbal) + Q (Quantitative) + AW (Analytical Writing) are based on GRE sections optimally weighted and then added together in an ordinary least squares regression model; CIP = Classification of Instructional Programs; UGPA = undergraduate grade point average; R^2 = proportion of variability in the criterion (graduate GPA) predicted; ΔR^2 over UGPA = amount of variability of the criterion predicted by GRE sections over and above what UGPA alone predicts; the subscript $_{+UGPA}$ indicates that the UGPA variable was included when calculating values; $\%C_{xj}$ = usefulness (general dominance) weight converted into the percentage of the R^2 attributable to a variable.

Table 21 Multivariate Analyses of Variables' Importance Based on Observed Data (Adjusted for Multivariate Range Variation): Doctorate Seekers

			General program area (with its 2-digit CIP code)						
		Overall	Education (13)	Engineering (14)	English language & literature/ letters (23)	Biological & biomedical science (26)	Mathematics & statistics (27)	Psychology (42)	Health professions & clinical science (51)
N		4,229	539	670	137	446	122	417	337
k		10	8	6	4	6	5	6	8
Model R (R^2)	R (R^2)	0.47 (0.22)	0.41 (0.17)	0.35 (0.12)	0.46 (0.21)	0.40 (0.16)	0.52 (0.27)	0.43 (0.18)	0.43 (0.18)
	R_{+UGPA} (R^2_{+UGPA})	0.55 (0.30)	0.47 (0.22)	0.51 (0.26)	0.58 (0.33)	0.47 (0.22)	0.59 (0.34)	0.63 (0.39)	0.53 (0.28)
ΔR^2 over UGPA	GRE V + Q + AW	0.12	0.10	0.06	0.13	0.10	0.15	0.11	0.16
	GRE Verbal Reasoning	0.05	0.06	0.01	0.08	0.06	0.04	0.03	0.06
	GRE Quantitative Reasoning	0.07	0.07	0.05	0.04	0.04	0.14	0.11	0.12
	GRE Analytical Writing	0.05	0.04	0.02	0.10	0.06	0.03	0.05	0.07
GRE Verbal	$\%C_{xj}$	27%	24%	31%	36%	36%	18%	16%	18%
Reasoning	$\%C_{xj+UGPA}$	16%	21%	6%	14%	26%	11%	5%	13%
GRE Quantitative	$\%C_{xj}$	40%	43%	41%	17%	21%	73%	55%	60%
Reasoning	$\%C_{xj+UGPA}$	22%	24%	22%	10%	13%	45%	23%	36%
GRE Analytical	$\%C_{xj}$	33%	33%	28%	48%	43%	10%	30%	21%
Writing	$\%C_{xj+UGPA}$	20%	31%	5%	32%	26%	9%	12%	18%
UGPA	$\%C_{xj}$	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	$\%C_{xj+UGPA}$	42%	24%	67%	44%	35%	36%	59%	33%

Note. All GRE sections were included in calculating tabled values; Model R (R^2) and GRE V (Verbal) + Q (Quantitative) + AW (Analytical Writing) are based on GRE sections optimally weighted and then added together in an ordinary least squares regression model; CIP = classification of instructional programs; UGPA = undergraduate grade point average; R^2 = proportion of variability in the criterion (graduate GPA) predicted; ΔR^2 over UGPA = amount of variability of the criterion predicted by GRE sections over and above what UGPA alone predicts; the subscript $_{+UGPA}$ indicates that the UGPA variable was included when calculating values; $\%C_{xj}$ = usefulness (general dominance) weight converted into the percentage of the R^2 attributable to a variable.

Table 22 GRE Quartile Comparisons: Doctorate Seekers

			General program area (with its 2-digit CIP code)						
		Overall	Education (13)	Engineering (14)	English language & literature/ letters (23)	Biological & biomedical science (26)	Mathematics & statistics (27)	Psychology (42)	Health professions & clinical science (51)
N		4,229	539	670	137	446	122	417	337
k		10	8	6	4	6	5	6	8
			Probability of grade of C+ or lower:						
GRE Verbal	Low quartile	22%	16%	34%	0%	27%	55%	10%	19%
Reasoning	High quartile	14%	8%	25%	6%	10%	25%	8%	19%
	Low/high	1.49	1.90	1.40	0.00	2.80	2.21	1.34	1.03
GRE Quantitative	Low quartile	21%	22%	25%	0%	23%	56%	11%	22%
Reasoning	High quartile	15%	9%	23%	3%	12%	29%	6%	14%
	Low/high	1.47	2.40	1.09	0.00	1.95	1.93	1.95	1.53
GRE Analytical	Low quartile	22%	13%	32%	0%	21%	38%	18%	20%
Writing	High quartile	13%	11%	22%	5%	8%	44%	9%	13%
	Low/high	1.64	1.19	1.45	0.00	2.48	0.86	1.94	1.59
			Probability of cumulative graduate GPA ≥ 3.8:						
GRE Verbal	High quartile	62%	83%	46%	94%	56%	35%	76%	58%
Reasoning	Low quartile	43%	58%	32%	88%	39%	24%	56%	41%
	High/low	1.45	1.43	1.42	1.07	1.43	1.43	1.36	1.41
GRE Quantitative	High quartile	60%	82%	51%	88%	55%	36%	75%	63%
Reasoning	Low quartile	43%	53%	35%	83%	39%	10%	64%	37%
	High/low	1.37	1.54	1.46	1.06	1.39	3.42	1.17	1.71
GRE Analytical	High quartile	60%	77%	49%	92%	58%	20%	76%	47%
Writing	Low quartile	44%	63%	41%	89%	36%	25%	52%	35%
	High/low	1.35	1.22	1.21	1.04	1.62	0.79	1.45	1.34

Note. CIP = classification of instructional programs; low quartile = lowest 25% of GRE scores; high quartile = highest 25% of GRE scores; low/high = low quartile divided by high quartile (how many times more likely a student in the lowest quartile would receive a grade of C+ in comparison to a student in the highest quartile); high/low = high quartile divided by low quartile (how many times more likely a student in the highest quartile would receive a cumulative graduate grade point average of at least 3.8 in comparison to a student in the lowest quartile).

Range Variation

Range variation describes the systematic effect on the magnitude of validity coefficients that results from the researcher possessing data for only enrolled students instead of the entire applicant pool. Generally, outcomes data (e.g., future GPA) are available for only those who have actually been accepted and then enrolled, rather than for the entire applicant pool. However, the researcher usually wants to know validity for the entire applicant pool. In other words, the researcher usually wants to know the answer to the question, "If every applicant had been accepted and enrolled—and, thus, I had outcomes data for all applicants—what would the validity metric (e.g., validity coefficient) equal?" In most admissions contexts, range variation takes the form of range restriction in that the predictor scores for the applicant pool usually are more varied than the predictor scores for the enrolled pool of students. Institutions generally select applicants with higher predictor scores, which results in a restriction (a narrowing in the range) of scores as one shifts focus from the applicant pool to the enrolled pool. Adjustments for range restriction will increase the magnitude of correlation coefficients. In some cases, range variation could take the form of range enhancement, in that the predictor scores for the applicant pool would be less varied than the predictor scores for the enrolled pool of students. It is possible that mainly those applicants with low or high predictor scores would be the ones to enroll in a program. This phenomenon would be more likely for less selective and less prestigious programs and for programs with an applicant pool whose predictor scores were not very variable. Adjustments for range enhancement would decrease the magnitude of correlation coefficients.

Range variation was addressed both univariately, using methods recommended by Hunter and Schmidt (2004), and multivariately, using methods recommended by Lawley (1943). The univariate adjustment is based on the following formula:

$$\rho_1 = \frac{U_x \rho_2}{\sqrt{\left(U_x^2 - 1\right)\rho_2^2 + 1}},$$

where ρ_1 = the validity coefficient adjusted for range variation, ρ_2 = the observed (unadjusted) validity coefficient, and $U_x = \frac{\sigma_{x1}}{\sigma_{x2}}$ (where σ_{x1} = the standard deviation for the applicant pool and σ_{x2} = the standard deviation for enrolled students; Hunter & Schmidt, 2004, p. 107). This formula assumes that a graduate program selected the applicant directly on the predictor (rather than on another independent variable that is correlated with that predictor). Each validity coefficient for each two-digit CIP code for each university was adjusted using this equation before the adjusted coefficients were sample-size weighted and averaged across universities for each two-digit CIP code within degree level.

The multivariate procedures were based on using matrix operations to solve for the elements of the following:

$$\Sigma_{(r)} = \begin{bmatrix} \Sigma_{(r)a} & \Sigma_{(r)b} \\ \Sigma_{(r)b}^T & \Sigma_{(r)c} \end{bmatrix},$$

where dimensionally $\Sigma_{(r)a}$ is $(p \times p)$, $\Sigma_{(r)b}$ is $(p \times (n-p))$, and $\Sigma_{(r)c}$ is $((n-p) \times (n-p))$ (see Lawley, 1943). In some of the literature on multivariate adjustment, $\Sigma_{(r)}$ is alternatively notated as υ (e.g., Ree, Carretta, Earles, & Albert, 1994). $\Sigma_{(r)a}$ (sometimes notated as $\upsilon_{p,p}$) = the variance-covariance matrix for predictor variables based on the entire applicant pool; $\Sigma_{(r)b}$ (sometimes notated as $\upsilon_{p,n\text{-}p}$ *or* $\upsilon_{n\text{-}p,p}$) = the covariances between predictors and the criterion based on the entire applicant pool; and $\Sigma_{(r)c}$ (sometimes notated as $\upsilon_{n\text{-}p,n\text{-}p}$) = the variance of the criterion based on the entire applicant pool. Only $\Sigma_{(r)a}$ is knowable, because values for predictors, but not the criterion, are available for those applicants who do not enroll. Nevertheless, one can estimate the remainder of the elements of $\Sigma_{(r)}$ with equations that incorporate $\Sigma_{(r)a}$ and data for the enrolled students (see Ree et al., 1994). We solved $\Sigma_{(r)}$ for each two-digit CIP code for each university within each degree level before the adjusted coefficients were sample-size weighted and averaged across universities and within degree level for each two-digit CIP code. These multivariate methods can be time-consuming to execute, might be less familiar to consumers of validity data, and require assumptions that the univariate methods do not (i.e., that the relationship between independent variables is linear). Furthermore, past validity studies (e.g., Kuncel, Hezlett, et al., 2001; Kuncel et al., 2010) to which one may want to compare validity coefficients used univariate adjustment procedures. Nevertheless, only the multivariate methods account for the overall impact of range variation on multiple predictors that are intercorrelated and collectively used in selection decisions. This is especially advantageous given that graduate admissions committees may use GRE sections and UGPA in a compensatory manner such that a high score on one predictor may offset a low score on another. Ruscio (1998, p. 569) observed that compensatory selection often "stacks the deck squarely against the predictive

validity of the GRE," because it depresses the magnitude of validity coefficients. Like Powers (2004) and Burton and Wang (2005), we employ multivariate procedures to avoid this risk.

Unreliability (Measurement Error)

Unreliability in the criterion systematically attenuates the magnitude of effect sizes (Hunter & Schmidt, 2004; Spearman, 1904). The inconsistency with which a criterion (or independent variable) assesses students places a ceiling on how accurately an independent variable may predict that criterion. One could adjust (increase) the magnitude of the attenuated correlation by dividing it by the square root of reliability, or, in the case of an imperfectly reliable predictor and criterion, the product of the square roots of their reliabilities (Hunter & Schmidt, 2004; Spearman, 1904). In an operational context, a predictor is accountable for attenuation that its own unreliability causes. Arguably, it is not accountable for attenuation that the criterion causes even if that unreliability is an ingrained part of the operational context. On the other hand, making adjustments to a validity coefficient based on criterion unreliability does not reflect operational reality. The use or non-use of the predictor will not change a criterion that a graduate program uses, no matter how unreliable the criterion might be. As a compromise among competing considerations, we noted for each validity coefficient what the reliability of the criterion was and indicated the percentage decline in magnitude of a perfectly measured validity coefficient associated with that unreliability ($1 - \sqrt{r_{YY}}$, where r_{YY} = criterion reliability). For each two-digit CIP code for each degree level, we estimated measurement error in the criterion using Cronbach's alpha for students who had at least 10 course grades. As with adjustments for range variation, we calculated reliability coefficients for each two-digit CIP code for each university within each degree level before the adjusted coefficients were sample-size weighted and averaged across universities for each two-digit CIP code for each degree level.

Relative Importance/Usefulness and ΔR^2 *for Enrolled Students and the Applicant Pool*

For communicating the importance of a variable in prediction, the usefulness weight from dominance analysis (C_{xj}) is superior in several ways to zero-order correlations, regression weights (whether nonstandardized βs or standardized βs), incremental variance explained (ΔR^2s), and *t*-statistics (Budescu, 1993; J. W. Johnson, 2000). The usefulness weight is "the proportionate contribution each predictor makes to R^2, considering both its unique contribution and its contribution when combined with other variables" (J. W. Johnson, 2000, p. 1). It measures a predictor's direct effect when considered by itself, its total effect conditional on all other predictors, and partial effect conditional on subsets of predictors (Budescu, 1993). The usefulness weights of a set of predictors always sum to the R^2 for the regression model containing all of those predictors. In an analysis of general dominance, one calculates a usefulness weight for each variable by computing its ΔR^2 for a full regression model (containing that predictor) versus the full model without the predictor, as well as its ΔR^2s for all possible submodel comparisons. Since it is often unclear exactly which variables from the full regression model will actually be used in the future for decision making, in general dominance analysis all of these ΔR^2s are then averaged together to describe the variable's average usefulness. Azen and Budescu (2003) explained that this particular averaging methodology is an analysis of general dominance, as opposed to an analysis of each variable's contribution to R^2 across all regression models of a certain size (complete dominance analysis) or an analysis of each variable's average additional contribution to R^2 within regression models of a certain size (conditional dominance analysis). Using bootstrap methods, they showed that analysis of general dominance leads to very stable and replicable results. Since the usefulness weights sum to the R^2 for the full model, each usefulness weight can be thought of as a percentage of that R^2 (Budescu, 1993). In the end, one possesses ratio-level metrics of importance that describe how much of the predictable variance of the criterion is uniquely attributable to each independent variable on average.

There are several reasons why alternative metrics of predictor importance are problematic indicators of variable importance. If predictors are intercorrelated, then a zero-order correlation cannot communicate the unique contribution of an independent variable to prediction. A nonstandardized regression weight often cannot be compared to another nonstandardized regression weight, because each is dependent on the unit of measurement underlying its predictor (e.g., inches, feet, yards, etc.). For comparability, they would have to be standardized, but even highly intercorrelated, standardized predictors that are highly correlated with the criterion may have highly discrepant regression coefficients (J. W. Johnson, 2000). Regression weights can suffer from multicollinearity and/or suppressor effects (Budescu, 1993). J. W. Johnson (2000) enumerates other limitations, such as the exaggeration of the standardized beta weight for the predictor most

highly correlated with the dependent variable and a corresponding decline in the magnitude of the standardized beta weights of the other predictors. The *t*-statistics are not a viable alternative either, because they fail to account well for the intercorrelation of predictors (J. W. Johnson, 2000).

We did not locate any previous large-scale (or GRE) predictive validity studies that have used usefulness weights. Also, not only usefulness weights were calculated for GRE sections and UGPA for enrolled graduate students with GGPAs, but calculations using R^2s *for the applicant pool* (i.e., based on multivariate range variation adjustments) were also performed. As was first shown by Lawley (1943) and later elaborated upon by others (e.g., Birnbaum, Paulson, & Andrews, 1950), if the relationship between the dependent and independent variables is linear and the associated residuals are homoscedastic,[5] then the unknown parts of Σ_a, Σ_b, and Σ_c can be obtained from $\Sigma_{(r)}$:

$$\Sigma_b = \Sigma_a \Sigma_{(r)a}^{-1} \Sigma_{(r)b} \tag{1}$$

$$\Sigma_c = \Sigma_{(r)c} - \Sigma_{(r)b}^{T} \left(\Sigma_{(r)a}^{-1} - \Sigma_{(r)a}^{-1} \Sigma_a \Sigma_{(r)a}^{-1} \right) \Sigma_{(r)b} \tag{2}$$

Given the unrestricted covariance matrix (the matrix representing the entire applicant pool) obtained in this manner, one can compute the correlation matrix ρ as follows: $\rho = D^{-1} \Sigma D^{-1}$, where $D = \left(\Sigma^{\circ} I \right)^{\frac{1}{2}}$, that is, the square root of the diagonal matrix resulting from a Hadamard (i.e., element by element) product of Σ and the identity matrix. The correlation matrix allows the computation of the coefficient of multiple correlation through the relationship $R^2 = \underline{\sigma}^T \rho_{xx}^{-1} \underline{\sigma}$, where ρ_{xx} is the matrix of correlations among the independent variables, and $\underline{\sigma}$ is the vector of correlations between the dependent and independent variables. These procedures also allow one to calculate incremental variance explained (ΔR^2s) by the GRE and GRE sections over UGPA for predicting GGPA *for the applicant pool* in addition to traditional ΔR^2s based on observed data only.

Quartile Comparisons

Bridgeman, Burton, and Cline (2009) suggested a valuable comparison of outcomes for top versus bottom GRE score quartiles of enrolled students to illustrate predictive validity. Limitations of this approach include omitting part of the score distribution, communicating validity for enrolled students rather than the applicant pool, and conveying only univariate information when decision makers might simultaneously use more than one predictor. However, comparisons for top versus bottom GRE score quartiles more directly communicate the value of the GRE than do correlations, incremental coefficients of determination, and usefulness weights. This straightforward approach avoids statistical adjustments and assumptions that underlie alternative, more time-consuming methods and that may not fully hold (e.g., homoscedasticity). We also wanted to compare these alternative methods to a more straightforward approach to see the extent to which they are consistent in conveying validity. Therefore, we conducted GRE score quartile comparisons where the outcomes were (a) the probability of receiving a C+ or lower in a graduate course and (b) the probability of obtaining a graduate GPA of 3.8 or higher. As our review of the Internet revealed, some graduate schools and departments warn, place on probation, or dismiss a student receiving a C+ or lower in a graduate course, and, even with grade inflation, a graduate GPA of 3.8 can represent an important milestone of success.

Results and Discussion

Four types of validity analyses were conducted and reported in separate tables for each degree level: zero-order validity coefficient analyses with and without adjustments for range variation (Tables 15 and 19), multivariate validity and incremental validity analyses without adjustments for range variation (Tables 16 and 20), multivariate validity and incremental validity analyses with adjustments for range variation (Tables 17 and 21), and GRE quartile comparisons (Tables 18 and 22).

Zero-Order Validity

For the zero-order validity coefficient analyses, predictive validity was first examined based on zero-order validity coefficients (r) for each GRE section (reported in Tables 15 and 19). For reasons given previously, we did not adjust observed

validity coefficients (r_{obs}) for unreliability but do report the reliabilities (Cronbach's alphas) and the impact of unreliability on true validity (the coefficient when there are no statistical artifacts attenuating it). The reliabilities ranged from 0.64 to 0.76 for master's programs and 0.57 to 0.71 for doctoral programs (see Tables 15 and 19, respectively). These values were fairly narrow in range and generally smaller than criterion reliability values for grades used by Kuncel, Hezlett, et al. (2001) and Kuncel et al. (2010) for graduate programs (0.84, 0.84, and 0.80) and by Powers (2004) for veterinary programs (0.74 to 0.98, median = 0.92) to adjust the observed validity coefficients that they had obtained. Kuncel, Hezlett, et al.'s adjustments to GRE validity coefficients were based on the reliability of undergraduate grades, and Powers's estimates for the GRE were based on veterinary school data. If Kuncel, Hezlett, et al. (2001) would have used our estimates to adjust their validity coefficients, these coefficients mathematically would have resulted in even larger adjusted values, because our reliability estimates were smaller in magnitude than theirs (see Hunter & Schmidt, 2004; Spearman, 1904). For the current dataset, attenuation in the validity coefficient due to unreliability ranged from 13% to 20% for validities in master's programs and 16% to 24% for validities in doctoral programs (see Tables 15 and 19, respectively). The reductions in the magnitude of the validity coefficients indicate that the unreliability of the criterion is substantially penalizing the zero-order validity coefficients for the GRE examination, even though the GRE examination is not at fault. Nevertheless, it is expected that GGPA will continue to be the leading measure of academic achievement in graduate education; therefore, we did not adjust for measurement error in the criterion and instead accepted the consequence of criterion unreliability.

In order to account for the effect of range variation on the size of observed validity coefficients (r_{obs}), we separately report validity coefficients that were adjusted using univariate and multivariate methods. The r_{urv} values reflect the observed validity coefficients adjusted using univariate methods described previously (see Tables 15 and 19). The U_{RR}-ratio (the standard deviation for the applicant pool divided by the standard deviation for enrolled students) is reported for each coefficient (Hunter & Schmidt, 2004, p. 107) to reflect the amount of univariate range restriction (or enhancement) on the observed validity coefficient. In other words, the U_{RR}-ratios indicate how well an observed validity coefficient represents predictive validity for the applicant pool, rather than solely for the enrolled students. Values less than 1 indicate range enhancement, and greater values indicate range restriction. The closer the value is to 1, the better an observed validity coefficient represents predictive validity for the applicant pool. A large U_{RR}-ratio might indicate a program area's particular reliance on a GRE section in admissions. For all program areas for all sections at the master's and doctoral levels, the values are larger than 1, indicating widespread range restriction. For both master's and doctoral programs, the greatest univariate range restriction was for mathematics and statistics, as well as for psychology for the GRE Quantitative Reasoning section ($U_{RR} = 1.24 – 1.48$; see Tables 15 and 19). For those program areas, it is possible that the GRE Quantitative Reasoning section was used substantially to filter out applicants. Given the importance of quantitative ability to classroom success in mathematics and statistics graduate programs, as well as a number of psychology programs that heavily rely on quantitative reasoning skills, this finding is not surprising. There are several cases where explanations for considerable range restriction are less clear (e.g., $U_{RR} = 1.26$ for GRE Verbal Reasoning in engineering master's programs; $U_{RR} = 1.27$ for GRE Analytical Writing in mathematics and statistics doctoral programs; see Tables 15 and 19). It is possible that engineering master's programs heavily use the GRE Verbal Reasoning section and that mathematics and statistics doctoral programs heavily use the GRE Analytical Writing section to distinguish among candidates that the programs perceive to be too homogenous in (high) quantitative ability.

Given the substantial possibility that graduate programs engage in compensatory selection involving the GRE sections and UGPA, it seems most appropriate to communicate predictive validity to reflect the multivariate nature of admissions. We report the observed coefficients (r_{obs}) to show the effect of making adjustments that account for the effects of range variation on the size of validity coefficients. Furthermore, we report univariately adjusted values (r_{urv}) to (a) show that the multivariate procedures, in fact, do make an additional difference by reflecting the combined effect of intercorrelated predictors on selection and (b) provide coefficients that are comparable to GRE validity coefficients reported in Kuncel, Hezlett, et al. (2001) and Kuncel et al. (2010). Multivariate methods that do not consider UGPA (r_{mrv}) are reported along with those that do ($r_{mrv+UGPA}$), because (a) it is possible that some programs consider the GRE sections but not UGPA (i.e., when UGPAs come from an array of universities with varying grading standards), and (b) when making multivariate adjustments to the coefficients of GRE sections, it is important to understand the direction and degree of change in the coefficients' magnitudes when adjustment procedures consider additional predictors, such as UGPA. For both master's and doctoral programs, the general trend is for an increase in the size of the GRE validity coefficients as one shifts focus from (a) observed correlations (r_{obs}) to (b) univariately adjusted ones (r_{urv}) to (c) multivariately adjusted ones that exclude

UGPA from the adjustment procedure (r_{mrv}) to (d) multivariately adjusted ones that include UGPA in the adjustment procedure ($r_{mrv+UGPA}$; see Tables 15 and 19). Reversals in this trend occur but are the exception.

Based on Cohen's (1988) standards to judge the size of zero-order correlation coefficients, one might conclude that the GRE examination does not provide much predictive value. For each GRE section at the master's level, virtually all of the GRE zero-order validities adjusted for multivariate range variation with procedures that consider the impact of UGPA are what Cohen classifies as small to medium in magnitude (i.e., in the range of 0.10–0.30). The sizes of zero-order correlation coefficients for the GRE Verbal Reasoning and Quantitative Reasoning sections in predicting GGPA in master's level psychology programs are even smaller. For our eight exemplar master's programs, validity coefficients adjusted to account for the effects of multivariate range variation with procedures that consider the impact of UGPA can be found in Table 15. (For all master's level program areas, the adjusted coefficients appear in the appendix.) For GRE Verbal Reasoning, overall $r_{mrv+UGPA} = 0.17$ ($N = 21{,}127$, $k = 10$), and $r_{mrv+UGPA}$ values for specific program areas range from 0.09 for psychology ($N = 461$, $k = 9$) to 0.32 for English language and literature/letters ($N = 552$, $k = 9$). For GRE Quantitative Reasoning at the master's level, overall $r_{mrv+UGPA} = 0.15$ ($N = 21{,}127$, $k = 10$), and $r_{mrv+UGPA}$ values for specific program areas range from −0.01 for psychology ($N = 461$, $k = 9$) to 0.21 for mathematics and statistics ($N = 230$, $k = 8$), as well as health professions and clinical sciences ($N = 3{,}772$, $k = 10$). For GRE Analytical Writing at the master's level, overall $r_{mrv+UGPA} = 0.19$ ($N = 21{,}127$, $k = 10$), and $r_{mrv+UGPA}$ values for specific program areas range from 0.15 for business, management, and marketing ($N = 901$, $k = 9$) to 0.33 for English language and literature/letters ($N = 552$, $k = 9$). We note that the Analytical Writing section, introduced in October 2002, is often the strongest predictor of GGPA.

Adjusted zero-order validity coefficients for doctoral programs are somewhat larger than those for master's level programs, but, based on Cohen's (1988) rules of thumb, would still generally be considered small to moderate in size. For our seven exemplar program areas at the doctoral level, validity coefficients adjusted to account for the effects of multivariate range variation with procedures that consider the impact of UGPA can be found in Table 19. (For all doctoral level program areas, they can be found in the appendix.) For GRE Verbal Reasoning, overall $r_{mrv+UGPA} = 0.19$ ($N = 4{,}229$, $k = 10$), and $r_{mrv+UGPA}$ values for specific program areas range from 0.08 for engineering ($N = 670$, $k = 6$) to 0.30 for biological and biomedical sciences ($N = 446$, $k = 6$). For GRE Quantitative Reasoning at the doctoral level, overall $r_{mrv+UGPA} = 0.24$ ($N = 4{,}229$, $k = 10$), and $r_{mrv+UGPA}$ values for specific program areas range from 0.10 for English language and literature/letters ($N = 137$, $k = 4$) to 0.41 for mathematics and statistics ($N = 122$, $k = 5$). For GRE Analytical Writing at the doctoral level, overall $r_{mrv+UGPA} = 0.21$ ($N = 4{,}229$, $k = 10$), and $r_{mrv+UGPA}$ values for specific program areas range from 0.10 for engineering ($N = 670$, $k = 6$) to 0.32 for psychology ($N = 417$, $k = 6$). As with prediction at the master's level, the Analytical Writing section is often the strongest predictor of GGPA.

Usefulness (Utility) Based on Zero-Order Validity

As did Kuncel, Hezlett, et al. (2001), we question the assumption that large zero-order validity coefficients for the GRE are necessary to justify the usefulness of the GRE for predicting graduate school outcomes criteria. In general, highly important predictive relationships do not necessarily involve large zero-order correlation coefficients. For example, based on large-scale studies, the correlation (a) between taking aspirin and reducing the risk of a heart attack is a mere 0.02, (b) between the effect of divorce and a child's well-being is just 0.09, and (c) between the amount of destruction in brain tissue and learning impairment in monkeys and humans is only about 0.17 (Meyer et al., 2001). Even a biological relationship as seemingly in lockstep as U.S. adult height and weight is approximately 0.44 (Meyer et al., 2001). Given the results of these large-scale studies, highly important predictive relationships do not necessarily involve large zero-order correlation coefficients. Moreover, the utility literature also casts doubt on the requirement of large validity coefficients to signify usefulness. For example, if only half of an organization's current students (or employees) are satisfactory performers, and an organization uses top-down selection to select 80% of applicants based on a selection system with a validity coefficient of only 0.05, then more than half of the selected applicants will be successful students (or employees; Taylor & Russell, 1939).

Financially based analysis also puts into question a need for large zero-order validity coefficients to substantiate use of an assessment. According to Hunter and Hunter (1984), the gain (in dollars) from utilizing a selection system for 1 year can be calculated as follows:

$$N * T * r_{xy} * \sigma_y * \overline{X},$$

where N = the number of those selected; T = the average tenure of someone selected; r_{xy} = the validity coefficient of the predictor; σ_y = the economic value (usually in dollars) of 1 standard deviation of performance on the criterion per year; and $\overline{X}$ = the average performance on the predictor of selectees, in z-score units.[6] Although the validity coefficient itself can be no larger than 1, the effect of being multiplied against several values that usually are larger than 1 (some much larger) results in a product that is fairly sizeable.

A financial example of the usefulness to a graduate program of an assessment used to admit full-time Ph.D. students is somewhat simplified but, nevertheless, instructive. According to the National Research Council (2010), from 2002 to 2006, the average size of an entering class for a Ph.D. program was 5.8 students for the humanities and slightly larger for other broad fields of study. Envisioning a doctoral program that admits five doctoral students in a year ($N = 5$) is reasonable. Between the academic years 1992–1993 through 2003–2004, only 23% of Ph.D. students completed their doctoral degree in 5 years (Sowell, Zhang, Redd, & King, 2008), so a timetable of 5 years for degree completion is a conservative one ($T = 5$). The average performance on the predictor of selectees in z-score units ($\overline{X}$) for even moderately selective programs (admitting 30% of applicants) is greater than 1 (e.g., 1.17 for a 30% selection ratio; Hunter & Hunter, 1984).

The economic value of 1 standard deviation of doctoral student performance in dollars (σ_Y) is particularly difficult to determine, as is the broader issue of the economic value that graduate students provide. One can make the debatable assumption that the economic value that doctoral students provide reflects, at a minimum, the economic value provided to them in return through wages, stipends, waivers, and subsidies. Most doctoral students provide value to programs through tuition, fellowships, research assistantships, and/or teaching assistantships. Thus, in practice, σ_Y can measure several criteria as well as multidimensional criteria. For purposes of this example, assumptions about the criterion are necessarily simplified. Based on a 2008–2009 survey that the *Chronicle of Higher Education* (June, 2008) conducted with a geographically diverse group of 111 public and private not-for-profit universities, the lowest average annual stipend for graduate assistants was $13,265 (for sociology, based on the reports of 82 institutions), and the highest average stipend was $18,270 (for biology, based on the reports of 94 institutions). Ehrenberg, Klaff, Kezsbom, and Nagowski (2002) estimated that, for the 2000–2001 academic year, the average salary of a teaching assistant at a public research university without labor union representation of graduate students was $11,817. The foregoing dollar estimates of compensation exclude the economic value of subsidies for health insurance, as well as tuition and fee waivers. Eighty-four percent of schools surveyed by the *Chronicle of Higher Education* reported subsidizing at least part of graduate students' health insurance costs (June, 2008). In addition, the amount of waivers and subsidies that doctoral students receive is substantial. The average annual tuition for a full-time doctoral degree program in 2007–2008 (but measured in 2009–2010 dollars) was $11,900 for public institutions and $24,200 for private not-for-profit ones (NCES, 2011, Table A-48-1). In 2007–2008 (but measured in 2009–2010 dollars), average annual grants, assistantships, and other nonloan aid for full-time doctoral students totaled $20,300 ($9,100 in grants alone) at public institutions and $19,300 ($10,800 in grants alone) at private not-for-profit institutions (NCES, 2011, Table A-48-1). If one looks at just the subset of full-time doctoral students who received financial assistance (92% at public institutions and 94.5% at private not-for-profit ones), annual nonloan aid jumps to $30,700 ($14,100 in grants alone) at public institutions and $34,000 ($17,500 in grants alone) at private not-for-profit ones (NCES, 2011, Table A-48-2).

After finding reasonable inputs for calculating the economic value that doctoral students provide, the process for calculating σ_Y becomes fairly mechanical. Based on Schmidt and Hunter's (1983) empirically derived finding that value of output to pay is about 2 to 1, they advise deriving σ_Y by taking 40% of annual wages (see discussion in Hunter & Hunter, 1984). If wages are defined more broadly to include the dollar amounts described above for the lower end of stipends ($13,265) combined with tuition waivers ($11,900 for public universities and $24,200 for private not-for-profit ones), then σ_Y for public universities would equal $10,066 (40% of $25,165) and for private not-for-profit universities $14,986 (40% of $37,465). Whatever the predictor's validity coefficient is, in the case of public universities, it is being multiplied by $294,430 per year based on modest assumptions (i.e., 5 admittees * 5 years' tenure * σ_Y of $10,066 * 1.17 average performance on the predictor = $294,430). Even a validity coefficient of 0.05 would result in a gain of $14,721 (i.e., $294,430 * 0.05 = $14,721). Under this scenario, as long as total cost to the graduate program for using a predictor with a 0.05 validity coefficient is below $14,721, then the net gain/loss from using that predictor is positive. Based on the same methodology, for private not-for-profit programs, the multiplier for the validity coefficient is $438,340.50 (i.e., 5 admittees * 5 years' tenure * σ_Y of $14,986 * 1.17 average performance on the predictor = $438,340.50). This results in a gain of $21,917 even if the validity coefficient is a mere 0.05 (i.e., $438,340.50 * 0.05 = $21,917). Provided that the cost to the graduate program

for using a predictor with a 0.05 validity coefficient is below $21,917, then the net gain/loss from using that predictor is positive.

Although the inputs to calculate utility (including costs) will vary across specific program areas (and programs), one should note that the validity coefficients shown in Tables 15 and 19 (and even the values for incremental validity of the GRE test and its sections over and above UGPA depicted in Tables 16 and 20) are usually substantially larger than 0.05. Such an observation indicates that the financial benefits from using the GRE test (overall and individual sections) to make admissions and funding decisions can be considerable. Using the conservative assumptions above for public universities together with overall doctoral $r_{mrv+UGPA}$ values for the GRE Verbal Reasoning, GRE Quantitative Reasoning, and GRE Analytical Writing sections from Table 19 (0.19, 0.24, and 0.21, respectively), the annual gain (without consideration of costs) to an SUS doctoral graduate program would be $55,940 just from using the GRE Verbal Reasoning section, $70,661 just from using the GRE Quantitative Reasoning section, and $61,828 just from using the GRE Analytical Writing section. If these calculations instead had used observed zero-order validity coefficients unadjusted for range variation (r_{obs} values in Table 19 of 0.13, 0.15, and 0.16, respectively), an SUS doctoral program's annual gain (without consideration of costs) still would have been $38,282 just from using the GRE Verbal Reasoning section, $44,175 just from using the GRE Quantitative Reasoning section, and $47,123 just from using the GRE Analytical Writing section.

Multivariate Metrics for Validity

Validity metrics beyond zero-order correlations substantiate that the GRE test provides important predictive value. Multiple correlations (*R*s) for the GRE Verbal Reasoning, GRE Quantitative Reasoning, and GRE Analytical Writing sections, adjusted for multivariate range variation, illustrate that combining the sections into a regression model leads to more moderate effect sizes (i.e., often 0.30 and higher) as measured by Cohen's (1988) standards.[7] Unlike traditional regression approaches, which reflect validity for enrolled students only (and for which results are reported in Tables 16 and 20), these adjusted values represent predictive validity for the entire applicant pool. For programs at the master's level, the overall R (R^2) = 0.33 (0.11) (N = 21,127, k = 10), with values ranging from 0.20 (0.04) for education (N = 4,649, k = 10) to 0.55 (0.30) for psychology (N = 461, k = 9). Multiple correlations and corresponding coefficients of determination for all eight of our exemplar program areas at the master's level can be found in Table 17 (and for all master's level program areas in the appendix). For programs at the doctoral level, the overall R (R^2) = 0.47 (0.22) (N = 4229, k = 10), with values ranging from 0.35 (0.12) for engineering (N = 670, k = 6) to 0.52 (0.27) for mathematics and statistics (N = 122, k = 5). Multiple correlations and corresponding coefficients of determination for all seven of our exemplar program areas at the doctoral level can be found in Table 21 (and for all doctoral level program areas in the appendix).

Note how these values for both master's and doctoral programs greatly exceed the correlation between taking aspirin and reducing the risk of heart attack (0.02); between the effect of divorce and child well-being (0.09); and between the amount of brain tissue destruction and learning impairment in monkeys and humans (0.17). Many of these validity coefficients either exceed or are almost as large as the correlation between U.S. adult weight and height (0.44; Meyer et al., 2001). Even multiple correlations unadjusted for range variation almost always exceed 0.20, and usually 0.30, especially for the prediction of GGPA in doctoral programs (see Tables 17 and 21).

Admissions committees frequently use the GRE and UGPA in conjunction with each other in a compensatory manner (Powers, 2004; Walpole et al., 2002). A question that may arise is whether the GRE can add to prediction of graduate school success when admissions committees already possess applicants' UGPAs. At both the master's and doctoral degree levels, all GRE sections, together and individually, provide incremental validity above and beyond UGPA overall and across the reported program areas. This incremental prediction by the GRE occurs whether or not one adjusts for range variation. Although the increment is usually greater after adjusting for range variation, all of the values in Tables 17 and 21 (adjusted for range variation) and Tables 16 and 20 (not adjusted for range variation) for "ΔR^2 over UGPA" exceed zero. That observation includes the increments in validity that the GRE Analytical Writing section used alone provides. The smallest unadjusted or adjusted value of "ΔR^2 over UGPA" anywhere among exemplar program areas is 0.01, which is equal to an incremental multiple correlation (ΔR) of 0.10. As discussed above, a zero-order correlation of only half of that size (i.e., 0.05) has substantial predictive value. Yet, this "ΔR^2 over UGPA" of 0.01 reflects predictive validity *over and above UGPA*, and most of the values for "ΔR^2 over UGPA" are several times the size of 0.01. If one uses the overall, adjusted, doctoral value of 0.12 for "ΔR^2 over UGPA" in Table 21 (approximately equal to a ΔR value of 0.35), then, based on the conservative assumptions that we have previously made for public universities, the annual gain to an SUS

doctoral graduate program (without consideration of costs) from using optimally weighted sections of the GRE together (i.e., Verbal Reasoning + Quantitative Reasoning + Analytical Writing) would be $103,054 *over and above any financial gain from already using UGPA in predicting GGPA*.[8] This incremental coefficient of determination of 0.12 is adjusted to account for multivariate range variation; if instead the unadjusted value of 0.15 (i.e., a ΔR value of approximately 0.39) was used (see Table 20), then the annual gain to an SUS doctoral graduate program (without consideration of costs) would be $114,871 *over and above any financial gain from already using UGPA in predicting GGPA*.

In addition, the average contribution of the GRE sections to the amount of variability that they explain when used in conjunction with UGPA is substantial. For predicting GGPA in doctoral programs, GRE sections usually account for the majority of the variance that they and UGPA collectively explain. These findings hold whether or not one adjusts for the impact of range variation. In Tables 16 and 17 (master's level programs) and Tables 20 and 21 (doctoral programs), $\%C_{xj+UGPA}$ (a percentage based on a usefulness weight from general dominance analysis; Budescu, 1993) represents the percentage of the R^2 that is uniquely attributable to a GRE section or UGPA, on average, when it might be considered in admissions decisions along with other predictors. *On average* signifies the fact that usefulness weights reflect R^2 from all possible regression submodels in addition to a regression model containing all variables. In Table 17 (usefulness weight percentages adjusted for range variation) and Table 16 (usefulness weight percentages not adjusted for range variation), $\%C_{xj+UGPA}$ for UGPA in predicting GGPA for master's level programs is 56% (53% unadjusted) overall, with a minimum value of 32% (29% unadjusted) and a maximum value of 69% (67% unadjusted). On average, across master's level program areas, GRE sections uniquely account for more than 40% of the variability in GGPA that GRE and UGPA collectively explain. At worst, GRE sections uniquely account, on average, for about one third of the variance in GGPA for a particular program area. At best, they account, on average, for about two thirds of it. The validity findings for the GRE sections in predicting GGPA are even stronger for doctoral level programs. In Table 21 (usefulness weight percentages adjusted for range variation) and Table 20 (usefulness weight percentages unadjusted for range variation), $\%C_{xj+UGPA}$ for UGPA in predicting GGPA for doctoral level programs is 42% (40% unadjusted) overall, with a minimum value of 24% (23% unadjusted) and a maximum value of 67% (69% unadjusted). On average, across doctoral level program areas, they uniquely account for more than half of the variability in GGPA that GRE and UGPA collectively explain. At worst, GRE sections uniquely account on average for about one third for a particular program area for doctoral level programs and, at best, they uniquely account on average for about three quarters. Sometimes, the newer GRE Analytical Writing section is, among the GRE sections, the one to which the largest percentage of variance explained is attributable.

GRE Quartile Comparisons

An observer might question the statistical metrics and their adjustments that we have reported thus far. Underlying these metrics and adjustments are sensible, yet abstract, arguments (e.g., that adjustments for range variation are necessary so that a validity coefficient represents the population about which we want to draw a conclusion), statistical assumptions that might not hold true (e.g., homoscedasticity), and mathematical operations that—while sound—might seem intricate and opaque to stakeholders such as admissions committees in nonmathematical disciplines (e.g., solving for $\Sigma_{(r)} = \begin{bmatrix} \Sigma_{(r)a} & \Sigma_{(r)b} \\ \Sigma_{(r)b}^{T} & \Sigma_{(r)c} \end{bmatrix}$ when adjusting for multivariate range variation). Consequently, we adopt the straightforward methodology of Bridgeman et al. (2009) to report differences in specific graduate grade thresholds (i.e., the probability of achieving a graduate school grade of C+ or lower and the probability of achieving a GGPA of at least 3.8) for the top versus bottom GRE score quartiles for each GRE section. As mentioned, we use the previously discussed validity metrics and their adjustments because they account for the entire distribution of scores, can represent validity for the applicant pool, allow for multivariate comparisons for a single dataset (e.g., GRE sections vs. UGPA), and permit comparisons to similar validity metrics (usually zero-order correlations) that have been used in many past validity studies.

Achieving a graduate school grade of C+ or lower can result in at least an academic warning from a graduate school or department. In Table 18 (master's level programs) and Table 22 (doctoral level programs), all but two sets of low/high values for this criterion across GRE sections are uniformly greater than 1, indicating that enrollees who received scores in the lowest GRE quartile were more likely than enrollees who received scores in the highest GRE quartile to achieve a grade of C+ or lower. Note that these trends generally hold for the newer GRE Analytical Writing section as well. For master's students overall, 26% of those who scored in the bottom quartile for GRE Analytical Writing achieved a graduate school grade of C+ or lower. Only 16% of those who scored in the top quartile for GRE Analytical Writing achieved this

same result. Therefore, 1.65 times as many students in the bottom quartile versus the top quartile (26%/16%) obtained a graduate school grade of C+ or lower. Findings for the probability of attaining a GGPA of at least 3.8 also show validity for the GRE sections, including the Analytical Writing section. Even with grade inflation, achieving a 3.8 or higher GGPA (at least close to straight As) might represent a noteworthy accomplishment. As shown for all GRE sections in Table 18 (master's level programs) and Table 22 (doctoral level programs), more students achieved at least a 3.8 GGPA who had scored in the top GRE quartile than in the bottom quartile (i.e., all high/low values exceed 1). For instance, doctoral students in biological and biomedical sciences who scored in the top quartile on the GRE Quantitative Reasoning section were 1.39 times more likely than those who scored in the bottom quartile to attain a 3.8 or greater GGPA (55% of top quartile/39% of the bottom quartile; see Table 22). One exception to general findings of low/high values larger than 1 is across GRE sections for doctoral programs in English language and literature/letters, because none of the 34 enrollees who scored in the lowest quartile on a GRE section received a graduate school grade of C+ or lower. The other exception is for the GRE Analytical Writing section for doctoral programs in mathematics and statistics.

Conclusion

Although the research establishing and reaffirming the generalizable validity of the GRE is compelling (Burton & Wang, 2005; Kuncel, Hezlett, et al., 2001; Kuncel et al., 2010; Powers, 2004), our additional investigation builds upon it in important ways. We question the use of Cohen's (1988) framework to determine whether a validity coefficient signifies the usefulness of an assessment. A strict set of rules for determining the importance of a zero-order correlation is convenient, especially if the correlation lacks context. Nevertheless, context does matter. Since validity information drives behaviors with major consequences, the fact that only a subset of stakeholders might have the expertise necessary to place a validity coefficient into context does not alone justify strict adherence to a set of perfunctory rules. Many biological and psychological relationships (e.g., aspirin consumption and reduction in the risk of heart attack, destruction of brain tissue and learning impairment) that one might assume to be large by Cohen's (1988) standards are, in fact, small to moderate in size. However, we believe that they are, nevertheless, meaningful and important in the sense that they should promote behaviors that add value (e.g., encourage the use of aspirin to reduce the risk of heart attack, persuade graduate programs to require and use the GRE for admissions) and discourage behaviors that cause harm (e.g., dissuade parents from allowing their children to participate in activities that substantially risk brain injury, deter graduate programs from discontinuing use of the GRE for admissions).

Zero-order correlations and alternative metrics to zero-order correlations demonstrate that the GRE sections, including the Analytical Writing section introduced in October 2002, provide value alone and in comparison to UGPA, the predictor with which GRE sections are often used by admissions committees in a compensatory manner.[9] Whether one looks at the multiple correlation for regression models of GRE sections (R), the incremental coefficient of determination (ΔR^2) for GRE sections over and above UGPA, usefulness weight percentages ($\%C_{xj}$), or GRE quartile comparisons (high/low or low/high), one observes abundant empirical evidence that the GRE sections provide value in decision making if the accurate prediction of GGPA is one's objective. GGPA remains the most common measure of graduate student performance.

In addition, we did not adjust any of the validity metrics that we reported (i.e., zero-order correlations, multiple correlations, incremental coefficients of multiple determination, usefulness weights, or quartile comparisons) for measurement error in the criterion. With an outcome measure of academic achievement more reliable than GGPA, we would have seen higher values for validity. However, those other measures were unavailable in our dataset, and, as already noted, GGPA remains the most commonly used outcome measure of graduate student success. Furthermore, and as has been the case for most predictive validity studies, we did not account for self-selection effects. In other words, the validity metrics that we provide are attenuated by the range restriction that results from people deciding not to even apply to a program area because their scores are too low. With the Law School Admission Test (LSAT) used as a comparison measure, research has demonstrated in the selection context that range restriction increases markedly when people know their scores in advance, as opposed to being ignorant about them (Kuncel & Klieger, 2007). Unlike the GRE test, admissions variables such as UGPA, personal statements, and letters of recommendation suffer from inflationary and leniency effects (V. Johnson, 2003; Murphy et al., 2009; Vannelli et al., 2007). Consequently, we believe that range restriction due to self-selection effects would be larger for the GRE than for other admissions variables.[10]

There are some limitations to our arguments and study. The seriousness of the consequences involved in other types of relationships that do not have large effect sizes by Cohen's (1988) standards (i.e., heart attack, brain damage) is readily observable, precisely measurable, and practically indisputable. The seriousness of the consequences for failing to use the GRE is more opaque. Some graduate programs might be willing to confidentially provide remediation for those students who lack the ability to perform well, even though that remediation has costs. Alternatively, some graduate programs might surreptitiously adjust their outcome criterion standards and graduate into society students who lack KSAOs needed for success. Although these effects might go unseen and thus unmeasured, they remain real and become someone's cost or problem. Furthermore, our utility analyses (based on Hunter & Hunter, 1984, and Taylor & Russell, 1939) rest on assumptions that may be oversimplified or incorrect. In real-world contexts, graduate school (and workplace) performance is multidimensional and fluctuates over time, so a single cutoff score for criterion performance assumed by Taylor and Russell (1939) is arguably inauthentic. In financial analyses of utility, the dollar value for a unit of improvement in criterion performance (σ_y) usually is ambiguous.

In addition, our statistical procedures for estimating validity (e.g., adjustment for multivariate range variation) depend on assumptions that might not hold true (e.g., that the relationship between the dependent and independent variables is linear, and the associated residuals are homoscedastic). We did not test linearity or homoscedasticity assumptions. Among other considerations, there is a very high risk of several false positives (250 tests * Type I error rate of 0.05 = 12.5). Moreover, to account for the impact of range variation, we made univariate adjustments that do not require any assumptions about the relationships between independent variables, and they substantiate the predictive value of the GRE examination. Furthermore, the quartile comparisons approach neither made nor required either a linearity or homoscedasticity assumption at all, and, as one saw, the results of the quartile comparisons approach evidenced GRE predictive validity. Additionally, our utility analyses showed substantial predictive value for the GRE test based on validity metrics that were not at all adjusted for the impact of range restriction.

Although our alternatives to zero-order effect sizes do evidence predictive validity of the GRE, it is not mathematically necessary that they do so in other contexts (for other university systems, for different program areas, etc.). We cannot generalize validity beyond the context for which we have data. Notwithstanding these concerns, we believe that our approaches were reasonable and would replicate in other contexts. Nevertheless, we firmly believe that additional investigation is necessary. Future validity studies should employ as many validity metrics as resources permit — such as multiple correlation for regression models (R), the incremental coefficient of determination (ΔR^2), usefulness weight percentages ($\%C_{xj}$), and quartile comparisons (high/low or low/high) — to ascertain predictive validity for specific contexts, as well as for validity generalization purposes. Given the compensatory nature of predictors in many situations, they should account for range variation in a multivariate way. Zero-order, incremental, and other validity information should be translated into — and then should be communicated in — language that decision makers who are less familiar with psychometrics and statistics can more readily understand. These translations could include how use of the GRE test (or any other assessment) affects the probability of admitted students' success in graduate school, how much better admitted students will perform in graduate school if selected with the assessment (rather than without it), and the net financial value that use of the assessment provides to stakeholders. In the United States, one of the fundamental legal precepts regarding the worth of a piece of evidence is that "a brick is not a wall" (Advisory Comm.'s Notes to Federal Rule of Evidence § 401, quoting McCormick, Strong, & Broun, 1992, § 152, p. 317). We adopt the same perspective here. That is, we maintain that it is unreasonable to expect zero-order validity coefficients (especially based on an inflexible set of interpretative guidelines) to fully settle the question of whether an assessment demonstrates sufficient predictive value. Each additional analysis and argument adds another brick to the wall and can, thereby, increase our confidence about what a zero-order correlation tells us and does not tell us about the value of an assessment.

Notes

1 Includes tuition and fees, books and educational supplies, living expenses, and other education-related costs.

2 The inclusion in this study of data for the new GRE Analytical Writing section is especially notable due to the lack of existing predictive validity evidence for this GRE section. The data analyzed in other studies (Burton & Wang, 2005; Kuncel, Hezlett, et al., 2001; Kuncel et al., 2010; Powers, 2004) were from GRE examinations taken prior to the introduction of the new Analytical Writing section in October, 2002.

3 As we discuss elsewhere, although GGPA is a highly imperfect assessment of student success, (a) it is likely to continue to be the most widely used measure of graduate student performance for the foreseeable future, and (b) we could not analyze other criterion outcomes (e.g., time to graduate degree completion, graduate school faculty ratings of graduate student performance, etc.) due to lack of clear information. We strongly encourage researchers and other stakeholders interested in GRE predictive validity to examine these alternatives to GGPA (as did Kuncel, Hezlett, et al., 2001; Kuncel et al., 2010; Burton & Wang, 2005) because (a) they might be more reliable measures of academic achievement, and (b) they might measure aspects of graduate student success that GGPA does not.

4 We did not employ hierarchical linear modeling (HLM) per se. (Correlation is a special case of regression, and, as we would have done with HLM, we identified separate subgroups whose lines of best fit might differ from those of other subgroups.) As we mentioned elsewhere, we selected the subgroups for which we separately report validity metrics (i.e., degree levels and program areas) based on a combination of what we thought would make theoretical sense as well as a desire to maintain reasonable sample sizes. Additional subgroup analyses were limited by considerations of sample size, as well as a lack of information in the SUS data that would allow us to create those subgroups. Furthermore, our methods avoid at least some of the problems associated with the use of regression weights (see our discussion in the section titled "Relative Importance/Usefulness and ΔR^2 for Enrolled Students and the Applicant Pool").

5 We did not test linearity or homoscedasticity assumptions. Please refer to our discussion of limitations in the "Conclusions" section.

6 Similar formulations appear in Brogden (1949) and Cronbach and Gleser (1965).

7 Had we reason to consider statistical shrinkage of multiple correlations in this study (and the impact on incremental coefficients of determination and usefulness weights), the effect of that shrinkage on values that we calculated would be minimal. This is partly due to the fact that our sample sizes (*N*s) for exemplar groups defined by two-digit CIP codes within each degree level are at least 122. Shrinkage results from a kind of sampling error for the value of a regression-based multiple correlation, *R*, but its impact on the value of *R* is systematic in direction. As its name suggests, the effect of shrinkage is always to reduce the value of *R*. When a regression equation is reused on the population or another sample, it is not optimal, as it was for the sample on which it was based; hence, the multiple correlation for the population or the new sample is smaller than it was for the original sample. The size of the original multiple correlation (*R*), the size of the original sample (*N*), and the number of predictors (p) determine the amount of shrinkage (Einhorn & Hogarth, 1975). Across all multiple correlations for our exemplar program areas (whether or not adjusted for range variation and whether directly reported or used to calculate incremental coefficients of determination or usefulness weights), the worst-case shrinkage scenario in terms of relative (i.e., percentage) decrease in *R* would occur for doctoral programs in English language and literature/letters, where $N = 137$ and $p = 3$ (see Table 20). The amount of shrinkage in this case would reduce the multiple correlation from 0.37 (unadjusted for range variation) to 0.35 (based on formulae from Browne, 1975, and Cattin, 1980, that estimate shrunken *R* when the regression equation is reused on a new sample). Mathematically, the shrinkage effect from reuse of the regression equation on the population would be the same or smaller (see formula in Olkin & Pratt, 1958).

8 We used ΔR as the value for rxy in the utility formula from Hunter and Hunter (1984). All other values remain the same.

9 We were not surprised that the new GRE Analytical Writing section also demonstrated substantial predictive value. Based on interviews with subject matter experts and a literature review, Enright and Gitomer (1989) identified Explanation (which includes reasoning and the development of logical arguments) and Communication (which includes writing) as core competencies for success in graduate school. Furthermore, the "taxonomy of higher order performance components" that Campbell, McCloy, Oppler, and Sager (1993) developed based on research for the U.S. military included a written and oral communication task factor. Kuncel, Campbell, Hezlett, and Ones (2001), Reeve and Hakel (2001), and Oswald, Schmitt, Kim, Ramsay, & Gillespie (2004) have adapted the Campbell et al. (1993) taxonomy for use in higher education.

10 Burton and Wang (2005) is one study that attempted to account for self-selection effects to at least some extent by adjusting for restriction in range using GRE test-taking populations as references. GRE examinees might not apply to a graduate or professional program for reasons unrelated to their GRE scores (e.g., cost, distance from family, research interests). Therefore, although it can be a difficult undertaking, we recommend that, for purposes of range variation adjustments that account for self-selection effects, researchers first try to carefully identify examinees who did not apply to a graduate program in question for reasons related to their GRE scores, rather than primarily due to other considerations. Otherwise, procedures that account for the effects of range variation might nontrivially overadjust or underadjust predictive validity metrics.

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Appendix

Univariate and Multivariate Predictive Validity Analyses of GRE-GGPA Relationships for All Program Areas

Table A1 Zero-Order Correlations Between Cumulative Graduate Grade Point Average (GGPA) and GRE Sections Overall and for All Program Areas: Master's Seekers

General program area (with its 2-digit CIP code)		Overall	Agriculture & related sciences (01)	Natural resources & conservation (03)	Architecture & related services (04)	Area, ethnic, cultural, & gender studies (05)	Communication, journalism, related programs (09)
k (Total # of universities contributing data)		10	2	7	6	5	8
N (Total # of students contributing data)		21,127	194	165	569	144	716
Attenuation of ρ_{XY} due to unreliability of criterion (cumulative graduate GPA)	Cronbach's alpha	0.72	0.73	0.51	0.77	0.64	0.70
	Reduction in magnitude of ρ_{XY}	−15%	−14%	−28%	−13%	−20%	−16%
GRE Verbal Reasoning	Mean U_{RR}	1.12	1.16	1.15	1.13	1.24	1.19
	r_{obs}	0.15	0.19	0.25	0.24	0.21	0.17
	r_{urv}	0.16	0.22	0.28	0.27	0.25	0.18
	r_{mrv}	0.16	0.27	0.33	0.24	0.25	0.17
	$r_{mrv+UGPA}$	0.17	0.25	0.35	0.26	0.25	0.19
GRE Quantitative Reasoning	Mean U_{RR}	1.14	1.29	1.10	1.15	1.15	1.22
	r_{obs}	0.13	0.14	0.25	0.19	0.24	0.23
	r_{urv}	0.15	0.19	0.26	0.21	0.28	0.28
	r_{mrv}	0.14	0.22	0.33	0.20	0.27	0.24
	$r_{mrv+UGPA}$	0.15	0.23	0.34	0.20	0.26	0.24
GRE Analytical Writing	Mean U_{RR}	1.05	1.13	1.16	1.08	1.11	1.08
	r_{obs}	0.16	0.26	0.25	0.18	0.25	0.20
	r_{urv}	0.17	0.29	0.30	0.19	0.27	0.21
	r_{mrv}	0.19	0.32	0.28	0.18	0.29	0.21
	$r_{mrv+UGPA}$	0.19	0.31	0.27	0.19	0.28	0.21

Note. CIP = classification of instructional programs; GPA.

Table A2 Zero-Order Correlations Between Cumulative Graduate Grade Point Average (GGPA) and GRE Sections Overall and for All Program Areas: Master's Seekers

General program area (with its 2-digit CIP code)		Education (13)	Engineering (14)	Engineering technologies & engineering related fields (15)	Foreign languages, literature, & linguistics (16)	Family & consumer sciences/human sciences (19)	English language & literature/ letters (23)
k (Total # of universities contributing data)		10	7	2	6	2	9
N (Total # of students contributing data)		4,649	1,481	141	238	87	552
Attenuation of ρ_{XY} due to unreliability of criterion (cumulative graduate GPA)	Cronbach's alpha	0.70	0.76	0.80	0.67	0.66	0.69
	Reduction in magnitude of ρ_{XY}	−17%	−13%	−11%	−18%	−19%	−17%
GRE Verbal Reasoning	Mean U_{RR}	1.08	1.26	1.32	1.22	1.17	1.16
	r_{obs}	0.12	0.10	0.14	0.19	0.08	0.26
	r_{urv}	0.13	0.12	0.17	0.22	0.09	0.29
	r_{mrv}	0.13	0.12	0.15	0.19	0.04	0.30
	$r_{mrv+UGPA}$	0.15	0.14	0.14	0.18	0.07	0.32
GRE Quantitative Reasoning	Mean U_{RR}	1.10	1.06	1.25	1.11	1.45	1.07
	r_{obs}	0.09	0.13	0.33	0.16	−0.04	0.17
	r_{urv}	0.10	0.13	0.39	0.17	−0.08	0.18
	r_{mrv}	0.10	0.14	0.44	0.20	−0.10	0.15
	$r_{mrv+UGPA}$	0.12	0.14	0.43	0.19	−0.06	0.16
GRE Analytical Writing	Mean U_{RR}	1.04	1.04	0.92	1.16	1.00	1.06
	r_{obs}	0.14	0.14	0.20	0.19	0.08	0.28
	r_{urv}	0.15	0.15	0.19	0.21	0.09	0.29
	r_{mrv}	0.15	0.15	0.22	0.16	0.08	0.33
	$r_{mrv+UGPA}$	0.16	0.16	0.21	0.13	0.05	0.33

Note. CIP = classification of instructional programs.

Table A3 Zero-Order Correlations Between Cumulative Graduate Grade Point Average (GGPA) and GRE Sections Overall and for All Program Areas: Master's Seekers

General program area (with its 2-digit CIP code)		Liberal arts & sciences, general studies & humanities (24)	Library science (25)	Biological & biomedical sciences (26)	Mathematics & statistics (27)	Multi/ interdisciplinary studies (30)	Parks, recreation, leisure & fitness studies (31)
k (Total # of universities contributing data)		6	2	9	8	4	6
N (Total # of students contributing data)		118	867	445	230	75	375
Attenuation of ρ_{XY} due to unreliability of criterion (cumulative graduate GPA)	Cronbach's alpha	0.70	0.73	0.64	0.71	0.68	0.70
	Reduction in magnitude of ρ_{XY}	−17%	−15%	−20%	−16%	−17%	−16%
GRE Verbal Reasoning	Mean U_{RR}	1.01	1.08	1.10	1.14	1.14	1.13
	r_{obs}	0.12	0.06	0.13	0.06	0.19	0.07
	r_{urv}	0.13	0.07	0.13	0.06	0.22	0.07
	r_{mrv}	0.12	0.08	0.18	0.05	0.10	0.08
	$r_{mrv+UGPA}$	0.12	0.09	0.20	0.12	0.09	0.11
GRE Quantitative Reasoning	Mean U_{RR}	1.01	1.06	1.16	1.38	1.10	1.29
	r_{obs}	0.04	0.05	0.19	0.16	0.28	0.10
	r_{urv}	0.04	0.05	0.22	0.22	0.28	0.13
	r_{mrv}	0.05	0.05	0.17	0.25	0.09	0.12
	$r_{mrv+UGPA}$	0.05	0.07	0.15	0.21	0.10	0.15
GRE Analytical Writing	Mean U_{RR}	1.02	1.06	1.06	1.07	1.00	1.12
	r_{obs}	0.08	0.17	0.15	0.11	0.29	0.14
	r_{urv}	0.08	0.18	0.15	0.12	0.30	0.15
	r_{mrv}	0.16	0.18	0.19	0.08	0.07	0.16
	$r_{mrv+UGPA}$	0.16	0.19	0.20	0.17	0.06	0.16

Note. CIP = classification of instructional programs.

Table A4 Zero-Order Correlations Between Cumulative Graduate Grade Point Average (GGPA) and GRE Sections Overall and for All Program Areas: Master's Seekers

General program area (with its 2-digit CIP code)		Philosophy & religious studies (38)	Physical sciences (40)	Psychology (42)	Security & protective services (43)	Public administration & social service professions (44)
k (Total # of universities contributing data)		5	7	9	7	9
N (Total # of students contributing data)		81	240	461	469	1,713
Attenuation of ρ_{XY} due to unreliability of criterion (cumulative graduate GPA)	Cronbach's alpha	0.74	0.67	0.69	0.65	0.74
	Reduction in magnitude of ρ_{XY}	−14%	−18%	−17%	−19%	−14%
GRE Verbal Reasoning	Mean U_{RR}	1.23	1.30	1.24	1.05	1.11
	r_{obs}	0.04	0.14	0.07	0.16	0.16
	r_{urv}	0.05	0.16	0.09	0.17	0.18
	r_{mrv}	−0.01	0.04	0.08	0.18	0.17
	$r_{mrv+UGPA}$	−0.02	0.11	0.09	0.18	0.19
GRE Quantitative Reasoning	Mean U_{RR}	1.02	1.23	1.24	1.18	1.11
	r_{obs}	0.13	0.05	0.09	0.04	0.18
	r_{urv}	0.13	0.04	0.11	0.04	0.20
	r_{mrv}	−0.04	0.09	−0.02	0.07	0.19
	$r_{mrv+UGPA}$	−0.07	0.09	−0.01	0.07	0.21
GRE Analytical Writing	Mean U_{RR}	1.10	1.13	1.18	1.02	1.03
	r_{obs}	0.11	0.23	0.19	0.21	0.18
	r_{urv}	0.10	0.25	0.22	0.21	0.18
	r_{mrv}	0.19	0.24	0.31	0.26	0.18
	$r_{mrv+UGPA}$	0.18	0.26	0.23	0.27	0.20

Note. CIP = classification of instructional programs.

Table A5 Zero-Order Correlations Between Cumulative Graduate Grade Point Average (GGPA) and GRE Sections Overall and for All Program Areas: Master's Seekers

General program area (with its 2-digit CIP code)		Social sciences (45)	Visual & performing arts (50)	Health professions & clinical sciences (51)	Business, management, marketing (52)	History (54)
k (Total # of universities contributing data)		9	6	10	9	8
N (Total # of students contributing data)		1,133	744	3,772	901	289
Attenuation of ρ_{XY} due to unreliability of criterion (cumulative graduate GPA)	Cronbach's alpha	0.74	0.76	0.76	0.71	0.75
	Reduction in magnitude of ρ_{XY}	−14%	−13%	−13%	−16%	−14%
GRE Verbal Reasoning	Mean U_{RR}	1.13	1.06	1.09	1.14	1.16
	r_{obs}	0.21	0.12	0.18	0.11	0.14
	r_{urv}	0.24	0.13	0.19	0.13	0.15
	r_{mrv}	0.27	0.11	0.20	0.13	0.14
	$r_{mrv+UGPA}$	0.28	0.11	0.22	0.14	0.16
GRE Quantitative Reasoning	Mean U_{RR}	1.16	1.09	1.18	1.17	1.12
	r_{obs}	0.15	0.10	0.15	0.11	0.18
	r_{urv}	0.18	0.11	0.17	0.13	0.20
	r_{mrv}	0.19	0.09	0.18	0.13	0.15
	$r_{mrv+UGPA}$	0.21	0.09	0.21	0.15	0.17
GRE Analytical Writing	Mean U_{RR}	1.06	1.05	1.04	1.05	1.07
	r_{obs}	0.20	0.11	0.16	0.11	0.11
	r_{urv}	0.21	0.12	0.16	0.12	0.11
	r_{mrv}	0.21	0.12	0.18	0.13	0.11
	$r_{mrv+UGPA}$	0.21	0.12	0.20	0.15	0.15

Note. CIP = classification of instructional programs.

Table A6 Multivariate Analyses of Variables' Importance Based on Observed Data (No Adjustments for Range Variation): Master's Seekers

General program area (with its 2-digit CIP code)		Overall	Agriculture & related sciences (01)	Natural resources & conservation (03)	Architecture & related services (04)	Area, ethnic, cultural, & gender studies (05)	Communication, journalism, related programs (09)
k (Total # of universities contributing data)		10	2	7	6	5	8
N (Total # of students contributing data)		21,127	194	165	569	144	716
Model R (R^2)	R (R^2)	0.27 (0.07)	0.35 (0.13)	0.47 (0.23)	0.30 (0.09)	0.37 (0.14)	0.37 (0.14)
	R_{+UGPA} (R^2_{+UGPA})	0.36 (0.13)	0.44 (0.19)	0.54 (0.29)	0.42 (0.17)	0.44 (0.20)	0.47 (0.22)
ΔR^2 over UGPA	GRE V + Q + AW	0.07	0.07	0.19	0.08	0.13	0.10
	GRE Verbal Reasoning	0.03	0.02	0.08	0.05	0.02	0.05
	GRE Quantitative Reasoning	0.02	0.02	0.07	0.04	0.06	0.04
	GRE Analytical Writing	0.03	0.05	0.07	0.03	0.06	0.03
GRE Verbal Reasoning	β	0.07	0.19	0.10	0.14	0.07	−0.04
	β_{+UGPA}	0.07	0.13	0.12	0.13	0.04	0.06
	$\%C_{xj}$	30%	25%	22%	41%	27%	25%
	$\%C_{xj+UGPA}$	14%	11%	17%	18%	14%	15%
GRE Quantitative Reasoning	β	0.08	−0.01	0.17	0.11	0.16	0.29
	β_{+UGPA}	0.06	0.02	0.10	0.10	0.14	0.14
	$\%C_{xj}$	28%	13%	42%	26%	33%	41%
	$\%C_{xj+UGPA}$	14%	8%	25%	15%	24%	19%

Table A6 Continued

General program area (with its 2-digit CIP code)		Overall	Agriculture & related sciences (01)	Natural resources & conservation (03)	Architecture & related services (04)	Area, ethnic, cultural, & gender studies (05)	Communication, journalism, related programs (09)
GRE Analytical	β	0.12	0.18	0.19	0.08	0.18	0.18
Writing	β_{+UGPA}	0.10	0.14	0.16	0.06	0.15	0.11
	$\%C_{xj}$	40%	58%	34%	29%	37%	32%
	$\%C_{xj+UGPA}$	16%	29%	25%	10%	25%	14%
UGPA	β	N/A	N/A	N/A	N/A	N/A	N/A
	β_{+UGPA}	0.23	0.27	0.27	0.29	0.24	0.30
	$\%C_{xj}$	N/A	N/A	N/A	N/A	N/A	N/A
	$\%C_{xj+UGPA}$	53%	47%	30%	53%	33%	50%

Note. CIP = classification of instructional programs; UGPA = undergraduate grade point average; V = Verbal; Q = Quantitative; AW = Analytical Writing.

Table A7 Multivariate Analyses of Variables' Importance Based on Observed Data (No Adjustments for Range Variation): Master's Seekers

General program area (with its 2-digit CIP code)		Computer & information sciences (11)	Education (13)	Engineering (14)	Engineering technology & engineering related fields (15)	Foreign languages, literature, & linguistics (16)	Family & consumer sciences/ human sciences (19)
k (Total # of universities contributing data)		8	10	7	2	6	2
N (Total # of students contributing data)		278	4,649	1,481	141	238	87
Model R (R^2)	R (R^2)	0.37 (0.14)	0.19 (0.04)	0.21 (0.04)	0.38 (0.14)	0.32 (0.10)	0.21 (0.04)
	R_{+UGPA} (R^2_{+UGPA})	0.50 (0.25)	0.30 (0.09)	0.34 (0.12)	0.50 (0.25)	0.38 (0.15)	0.42 (0.18)
ΔR^2 over UGPA	GRE V + Q + AW	0.17	0.03	0.03	0.12	0.10	0.05
	GRE Verbal Reasoning	0.08	0.01	0.01	0.02	0.03	0.02
	GRE Quantitative Reasoning	0.05	0.01	0.01	0.10	0.01	0.02
	GRE Analytical Writing	0.05	0.02	0.01	0.03	0.02	0.01
GRE Verbal	β	0.08	0.06	0.02	0.02	0.10	0.09
Reasoning	β_{+UGPA}	0.08	0.07	0.03	0.00	0.09	0.06
	$\%C_{xj}$	33%	28%	20%	5%	32%	19%
	$\%C_{xj+UGPA}$	21%	12%	7%	3%	23%	7%
GRE Quantitative	β	0.16	0.03	0.10	0.30	0.15	−0.10
Reasoning	β_{+UGPA}	0.13	0.02	0.05	0.29	0.13	−0.19
	$\%C_{xj}$	40%	21%	36%	71%	17%	62%
	$\%C_{xj+UGPA}$	18%	9%	14%	35%	8%	10%
GRE Analytical	β	0.13	0.11	0.11	0.12	0.03	0.08
Writing	β_{+UGPA}	0.11	0.08	0.08	0.08	0.00	0.02
	$\%C_{xj}$	25%	47%	43%	22%	48%	21%
	$\%C_{xj+UGPA}$	12%	13%	11%	7%	25%	5%
UGPA	β	N/A	N/A	N/A	N/A	N/A	N/A
	β_{+UGPA}	0.27	0.23	0.27	0.26	0.18	0.39
	$\%C_{xj}$	N/A	N/A	N/A	N/A	N/A	N/A
	$\%C_{xj+UGPA}$	46%	64%	67%	52%	39%	78%

Note. CIP = classification of instructional programs; UGPA = undergraduate grade point average; V = Verbal; Q = Quantitative; AW = Analytical Writing.

Table A8 Multivariate Analyses of Variables' Importance Based on Observed Data (No Adjustments for Range Variation): Master's Seekers

General program area (with its 2-digit CIP code)		English language & literature/ letters (23)	Liberal arts & sciences, general studies & humanities (24)	Library science (25)	Biological & biomedical sciences (26)	Mathematics & statistics (27)	Multi/ interdisciplinary studies (30)
k (Total # of universities contributing data)		9	6	2	9	8	4
N (Total # of students contributing data)		552	118	867	445	230	75
Model R (R^2)	R (R^2)	0.37 (0.14)	0.38 (0.14)	0.18 (0.03)	0.33 (0.11)	0.35 (0.12)	0.55 (0.30)
	R_{+UGPA} (R^2_{+UGPA})	0.43 (0.19)	0.50 (0.25)	0.23 (0.05)	0.42 (0.18)	0.48 (0.23)	0.56 (0.31)
ΔR^2 over UGPA	GRE V + Q + AW	0.13	0.21	0.03	0.10	0.15	0.29
	GRE Verbal Reasoning	0.07	0.04	0.00	0.04	0.05	0.04
	GRE Quantitative Reasoning	0.02	0.05	0.00	0.04	0.05	0.14
	GRE Analytical Writing	0.07	0.07	0.02	0.03	0.03	0.07
GRE Verbal Reasoning	β	0.17	0.34	−0.01	−0.01	−0.03	0.00
	β_{+UGPA}	0.17	0.14	−0.01	−0.02	0.04	0.07
	$\%C_{xj}$	37%	53%	7%	31%	27%	17%
	$\%C_{xj+UGPA}$	30%	20%	5%	18%	13%	15%
GRE Quantitative Reasoning	β	0.02	−0.37	−0.01	0.21	0.30	0.19
	β_{+UGPA}	0.01	−0.25	0.00	0.18	−0.02	0.15
	$\%C_{xj}$	14%	12%	4%	41%	40%	43%
	$\%C_{xj+UGPA}$	9%	10%	3%	18%	15%	41%
GRE Analytical Writing	β	0.22	0.15	0.18	0.12	−0.07	0.12
	β_{+UGPA}	0.19	0.28	0.16	0.09	0.12	0.04
	$\%C_{xj}$	47%	33%	88%	27%	31%	37%
	$\%C_{xj+UGPA}$	29%	27%	49%	15%	16%	35%
UGPA	β	N/A	N/A	N/A	N/A	N/A	N/A
	β_{+UGPA}	0.18	0.06	0.14	0.24	0.34	−0.03
	$\%C_{xj}$	N/A	N/A	N/A	N/A	N/A	N/A
	$\%C_{xj+UGPA}$	29%	43%	43%	46%	56%	5%

Note. CIP = classification of instructional programs; UGPA = undergraduate grade point average; V = Verbal; Q = Quantitative; AW = Analytical Writing.

Table A9 Multivariate Analyses of Variables' Importance Based on Observed Data (No Adjustments for Range Variation): Master's Seekers

General program area (with its 2-digit CIP code)		Parks, recreation, leisure, & fitness studies (31)	Philosophy & religious studies (38)	Physical sciences (40)	Psychology (42)	Security & protective services (43)	Public administration & social service professions (44)
k (Total # of universities contributing data)		6	5	7	9	7	9
N (Total # of students contributing data)		375	81	240	461	469	1,713
Model R (R^2)	R (R^2)	0.24 (0.06)	0.47 (0.22)	0.4 (0.16)	0.35 (0.12)	0.34 (0.12)	0.24 (0.06)
	R_{+UGPA} (R^2_{+UGPA})	0.36 (0.13)	0.52 (0.27)	0.54 (0.29)	0.43 (0.19)	0.42 (0.17)	0.34 (0.11)
ΔR^2 over UGPA	GRE V + Q + AW	0.06	0.20	0.14	0.14	0.10	0.05
	GRE Verbal Reasoning	0.02	0.04	0.03	0.02	0.04	0.02
	GRE Quantitative Reasoning	0.02	0.06	0.05	0.06	0.02	0.03
	GRE Analytical Writing	0.02	0.06	0.04	0.05	0.05	0.02

Table A9 Continued

General program area (with its 2-digit CIP code)		Parks, recreation, leisure, & fitness studies (31)	Philosophy & religious studies (38)	Physical sciences (40)	Psychology (42)	Security & protective services (43)	Public administration & social service professions (44)
GRE Verbal	β	0.03	−0.12	0.03	0.02	0.06	0.06
Reasoning	β_{+UGPA}	0.03	−0.19	−0.03	0.05	0.07	0.04
	$\%C_{xj}$	25%	29%	26%	15%	48%	27%
	$\%C_{xj+UGPA}$	9%	22%	11%	11%	27%	13%
GRE Quantitative	β	0.06	0.03	−0.01	0.02	0.00	0.11
Reasoning	β_{+UGPA}	0.06	−0.01	−0.01	0.00	−0.04	0.11
	$\%C_{xj}$	37%	29%	36%	37%	13%	37%
	$\%C_{xj+UGPA}$	12%	24%	19%	26%	8%	17%
GRE Analytical	β	0.14	0.20	0.23	0.20	0.21	0.11
Writing	β_{+UGPA}	0.10	0.31	0.23	0.20	0.17	0.09
	$\%C_{xj}$	36%	41%	38%	47%	36%	30%
	$\%C_{xj+UGPA}$	13%	34%	14%	25%	21%	11%
UGPA	β	N/A	N/A	N/A	N/A	N/A	N/A
	β_{+UGPA}	0.26	0.13	0.34	0.20	0.23	0.23
	$\%C_{xj}$	N/A	N/A	N/A	N/A	N/A	N/A
	$\%C_{xj+UGPA}$	65%	18%	55%	37%	41%	54%

Note. CIP = classification of instructional programs; UGPA = undergraduate grade point average; V = Verbal; Q = Quantitative; AW = Analytical Writing.

Table A10 Multivariate Analyses of Variables' Importance Based on Observed Data (No Adjustments for Range Variation): Master's Seekers

General program area (with its 2-digit CIP code)		Social science (45)	Visual & performing arts (50)	Health professions & clinical science (51)	Business, management, marketing (52)	History (54)
k (Total # of universities contributing data)		9	6	10	9	8
N (Total # of students contributing data)		1,133	744	3,772	901	289
Model R (R^2)	R (R^2)	0.31 (0.10)	0.22 (0.05)	0.24 (0.06)	0.23 (0.05)	0.34 (0.12)
	R_{+UGPA} (R^2_{+UGPA})	0.40 (0.16)	0.28 (0.08)	0.35 (0.12)	0.32 (0.10)	0.52 (0.27)
ΔR^2 over UGPA	GRE V + Q + AW	0.08	0.05	0.06	0.06	0.15
	GRE Verbal Reasoning	0.04	0.02	0.03	0.02	0.03
	GRE Quantitative Reasoning	0.03	0.02	0.03	0.02	0.04
	GRE Analytical Writing	0.02	0.01	0.02	0.02	0.05
GRE Verbal Reasoning	β	0.13	0.06	0.11	0.06	0.06
	β_{+UGPA}	0.11	0.05	0.10	0.06	−0.01
	$\%C_{xj}$	35%	22%	41%	28%	42%
	$\%C_{xj+UGPA}$	17%	14%	18%	18%	19%
GRE Quantitative	β	0.08	0.05	0.08	0.07	0.14
Reasoning	β_{+UGPA}	0.08	0.05	0.09	0.06	0.15
	$\%C_{xj}$	24%	20%	28%	37%	33%
	$\%C_{xj+UGPA}$	14%	14%	17%	16%	15%
GRE Analytical Writing	β	0.12	0.07	0.10	0.09	0.07
	β_{+UGPA}	0.08	0.04	0.09	0.07	0.07
	$\%C_{xj}$	38%	57%	29%	33%	23%
	$\%C_{xj+UGPA}$	13%	24%	13%	16%	14%
UGPA	β	N/A	N/A	N/A	N/A	N/A
	β_{+UGPA}	0.25	0.17	0.24	0.20	0.36
	$\%C_{xj}$	N/A	N/A	N/A	N/A	N/A
	$\%C_{xj+UGPA}$	52%	47%	50%	48%	49%

Note. CIP = classification of instructional programs; UGPA = undergraduate grade point average; V = Verbal; Q = Quantitative; AW = Analytical Writing.

Table A11 Multivariate Analyses of Variables' Importance Based on Observed Data (Adjusted for Multivariate Range Variation): Master's Seekers

General program area (with its 2-digit CIP code)		Overall	Agriculture & related sciences (01)	Natural resources & conservation (03)	Architecture & related services (04)	Area, ethnic, cultural, & gender studies (05)	Communication, journalism, related programs (09)
k (Total # of universities contributing data)		10	2	7	6	5	8
N (Total # of students contributing data)		21,127	194	165	569	144	716
Model R (R^2)	R (R^2)	0.33 (0.11)	0.39 (0.16)	0.55 (0.3)	0.31 (0.1)	0.4 (0.16)	0.4 (0.16)
	R_{+UGPA} (R^2_{+UGPA})	0.43 (0.19)	0.46 (0.21)	0.63 (0.39)	0.44 (0.19)	0.46 (0.21)	0.48 (0.23)
ΔR^2 over UGPA	GRE V + Q + AW	0.06	0.08	0.20	0.07	0.13	0.10
	GRE Verbal Reasoning	0.03	0.04	0.08	0.05	0.03	0.05
	GRE Quantitative Reasoning	0.03	0.04	0.09	0.04	0.08	0.05
	GRE Analytical Writing	0.03	0.06	0.10	0.03	0.07	0.04
GRE Verbal	$\%C_{xj}$	29%	22%	18%	40%	26%	25%
Reasoning	$\%C_{xj+UGPA}$	14%	9%	15%	17%	16%	15%
GRE Quantitative	$\%C_{xj}$	31%	14%	42%	27%	35%	48%
Reasoning	$\%C_{xj+UGPA}$	14%	11%	22%	14%	23%	19%
GRE Analytical	$\%C_{xj}$	41%	63%	40%	33%	38%	27%
Writing	$\%C_{xj+UGPA}$	17%	32%	30%	10%	25%	12%
UGPA	$\%C_{xj}$	N/A	N/A	N/A	N/A	N/A	N/A
	$\%C_{xj+UGPA}$	56%	48%	33%	59%	37%	54%

Note. CIP = classification of instructional programs; UGPA = undergraduate grade point average; V = Verbal; Q = Quantitative; AW = Analytical Writing.

Table A12 Multivariate Analyses of Variables' Importance Based on Observed Data (Adjusted for Multivariate Range Variation): Master's Seekers

General program area (with its 2-digit CIP code)		Computer & information sciences (11)	Education (13)	Engineering (14)	Engineering technologies & engineering related fields (15)	Foreign languages, literature, & linguistics (16)	Family & consumer sciences/human sciences (19)
k (Total # of universities contributing data)		8	10	7	2	6	2
N (Total # of students contributing data)		278	4,649	1,481	141	238	87
Model R (R^2)	R (R^2)	0.36 (0.13)	0.20 (0.04)	0.22 (0.05)	0.47 (0.22)	0.38 (0.15)	0.22 (0.05)
	R_{+UGPA} (R^2_{+UGPA})	0.48 (0.23)	0.32 (0.10)	0.37 (0.14)	0.54 (0.29)	0.46 (0.21)	0.5 (0.25)
ΔR^2 over UGPA	GRE V + Q + AW	0.11	0.03	0.03	0.14	0.09	0.07
	GRE Verbal Reasoning	0.06	0.02	0.01	0.01	0.03	0.02
	GRE Quantitative Reasoning	0.05	0.01	0.02	0.13	0.02	0.05
	GRE Analytical Writing	0.04	0.02	0.01	0.03	0.03	0.01
GRE Verbal	$\%C_{xj}$	31%	23%	21%	2%	30%	19%
Reasoning	$\%C_{xj+UGPA}$	20%	11%	8%	2%	26%	6%
GRE Quantitative	$\%C_{xj}$	52%	24%	39%	82%	18%	66%
Reasoning	$\%C_{xj+UGPA}$	21%	8%	13%	42%	8%	12%
GRE Analytical	$\%C_{xj}$	17%	54%	40%	16%	52%	15%
Writing	$\%C_{xj+UGPA}$	10%	13%	10%	6%	26%	3%
UGPA	$\%C_{xj}$	N/A	N/A	N/A	N/A	N/A	N/A
	$\%C_{xj+UGPA}$	49%	67%	69%	50%	40%	80%

Note. CIP = classification of instructional programs; UGPA = undergraduate grade point average; V = Verbal; Q = Quantitative; AW = Analytical Writing.

Table A13 Multivariate Analyses of Variables' Importance Based on Observed Data (Adjusted for Multivariate Range Variation): Master's Seekers

General program area (with its 2-digit CIP code)		English language & literature/ letters (23)	Liberal arts & sciences, general studies & humanities (24)	Library science (25)	Biological & biomedical sciences (26)	Mathematics & statistics (27)	Multi/ interdisciplinary studies (30)
k (Total # of universities contributing data)		9	6	2	9	8	4
N (Total # of students contributing data)		552	118	867	445	230	75
Model R (R^2)	R (R^2)	0.41 (0.17)	0.23 (0.05)	0.19 (0.04)	0.36 (0.13)	0.42 (0.18)	0.64 (0.41)
	R_{+UGPA} (R^2_{+UGPA})	0.47 (0.22)	0.26 (0.07)	0.25 (0.06)	0.45 (0.21)	0.55 (0.3)	0.65 (0.42)
ΔR^2 over UGPA	GRE V + Q + AW	0.12	0.11	0.03	0.09	0.13	0.23
	GRE Verbal Reasoning	0.07	0.01	0.01	0.03	0.03	0.01
	GRE Quantitative Reasoning	0.02	0.02	0.00	0.04	0.06	0.16
	GRE Analytical Writing	0.07	0.03	0.03	0.04	0.03	0.06
GRE Verbal Reasoning	$\%C_{xj}$	40%	58%	10%	32%	22%	14%
	$\%C_{xj+UGPA}$	31%	18%	7%	18%	12%	14%
GRE Quantitative Reasoning	$\%C_{xj}$	10%	8%	3%	42%	47%	51%
	$\%C_{xj+UGPA}$	7%	7%	2%	18%	21%	46%
GRE Analytical Writing	$\%C_{xj}$	50%	34%	87%	26%	31%	36%
	$\%C_{xj+UGPA}$	30%	27%	48%	16%	17%	37%
UGPA	$\%C_{xj}$	N/A	N/A	N/A	N/A	N/A	N/A
	$\%C_{xj+UGPA}$	32%	48%	44%	48%	51%	3%

Note. CIP = classification of instructional programs; UGPA = undergraduate grade point average; V = Verbal; Q = Quantitative; AW = Analytical Writing.

Table A14 Multivariate Analyses of Variables' Importance Based on Observed Data (Adjusted for Multivariate Range Variation): Master's Seekers

General program area (with its 2-digit CIP code)		Parks, recreation, leisure, & fitness studies (31)	Philosophy & religious studies (38)	Physical sciences (40)	Psychology (42)	Security & protective services (43)	Public administration & social service professions (44)
k (Total # of universities contributing data)		6	5	7	9	7	9
N (Total # of students contributing data)		375	81	240	461	469	1,713
Model R (R^2)	R (R^2)	0.25 (0.06)	0.58 (0.33)	0.5 (0.25)	0.55 (0.30)	0.38 (0.14)	0.26 (0.07)
	R_{+UGPA} (R^2_{+UGPA})	0.4 (0.16)	0.63 (0.4)	0.6 (0.36)	0.65 (0.43)	0.45 (0.2)	0.36 (0.13)
ΔR^2 over UGPA	GRE V + Q + AW	0.06	0.24	0.12	0.13	0.09	0.05
	GRE Verbal Reasoning	0.02	0.02	0.12	0.03	0.04	0.03
	GRE Quantitative Reasoning	0.03	0.07	0.06	0.07	0.01	0.03
	GRE Analytical Writing	0.03	0.11	0.03	0.07	0.05	0.02
GRE Verbal Reasoning	$\%C_{xj}$	20%	30%	30%	16%	56%	23%
	$\%C_{xj+UGPA}$	7%	26%	11%	13%	21%	12%
GRE Quantitative Reasoning	$\%C_{xj}$	43%	25%	37%	35%	7%	43%
	$\%C_{xj+UGPA}$	14%	23%	21%	22%	4%	17%
GRE Analytical Writing	$\%C_{xj}$	37%	45%	33%	48%	37%	35%
	$\%C_{xj+UGPA}$	14%	44%	14%	23%	20%	15%
UGPA	$\%C_{xj}$	N/A	N/A	N/A	N/A	N/A	N/A
	$\%C_{xj+UGPA}$	65%	7%	53%	41%	54%	56%

Note. CIP = classification of instructional programs; UGPA = undergraduate grade point average; V = Verbal; Q = Quantitative; AW = Analytical Writing.

Table A15 Multivariate Analyses of Variables' Importance Based on Observed Data (Adjusted for Multivariate Range Variation): Master's Seekers

General program area (with its 2-digit CIP code)		Social sciences (45)	Visual & performing arts (50)	Health professions & clinical sciences (51)	Business, management, marketing (52)	History (54)
k (Total # of universities contributing data)		9	6	10	9	8
N (Total # of students contributing data)		1,133	744	3,772	901	289
Model R (R^2)	R (R^2)	0.38 (0.15)	0.22 (0.05)	0.28 (0.08)	0.25 (0.06)	0.37 (0.14)
	R_{+UGPA} (R^2_{+UGPA})	0.46 (0.21)	0.28 (0.08)	0.40 (0.16)	0.37 (0.13)	0.54 (0.29)
ΔR^2 over UGPA	GRE V + Q + AW	0.08	0.05	0.06	0.05	0.13
	GRE Verbal Reasoning	0.05	0.03	0.04	0.02	0.04
	GRE Quantitative Reasoning	0.04	0.03	0.04	0.02	0.04
	GRE Analytical Writing	0.03	0.01	0.03	0.02	0.05
GRE Verbal Reasoning	$\%C_{xj}$	35%	23%	40%	32%	42%
	$\%C_{xj+UGPA}$	19%	14%	16%	21%	19%
GRE Quantitative Reasoning	$\%C_{xj}$	24%	22%	34%	37%	36%
	$\%C_{xj+UGPA}$	15%	14%	17%	15%	16%
GRE Analytical Writing	$\%C_{xj}$	41%	55%	26%	31%	22%
	$\%C_{xj+UGPA}$	16%	22%	12%	17%	14%
UGPA	$\%C_{xj}$	N/A	N/A	N/A	N/A	N/A
	$\%C_{xj+UGPA}$	50%	50%	55%	47%	51%

Note. CIP = classification of instructional programs; UGPA = undergraduate grade point average; V = Verbal; Q = Quantitative; AW = Analytical Writing.

Table A16 GRE Quartile Comparisons: Master's Seekers

General program area (with its 2-digit CIP code)		Overall	Agriculture & related sciences (01)	Natural resources & conservation (03)	Architecture & related services (04)	Area, ethnic, cultural, & gender studies (05)	Communication, journalism, related programs (09)
k (Total # of universities contributing data)		10	2	7	6	5	8
N (Total # of students contributing data)		21,127	194	165	569	144	716
		Probability of grade of C+ or lower					
GRE Verbal Reasoning	Low quartile	25%	36%	19%	37%	20%	21%
	High quartile	16%	15%	12%	13%	8%	15%
	Low/high	1.57	2.37	1.57	2.83	2.59	1.41
GRE Quantitative Reasoning	Low quartile	25%	18%	22%	37%	20%	30%
	High quartile	17%	18%	10%	21%	5%	15%
	Low/high	1.50	0.97	2.34	1.75	3.59	2.03
GRE Analytical Writing	Low quartile	26%	26%	11%	42%	20%	22%
	High quartile	16%	12%	2%	22%	5%	16%
	Low/high	1.65	2.11	5.32	1.86	3.67	1.35
		Probability of cumulative graduate GPA $\geq$ 3.8					
GRE Verbal Reasoning	High quartile	58%	58%	71%	46%	66%	46%
	Low quartile	36%	30%	50%	16%	31%	22%
	High/low	1.62	1.96	1.43	2.95	2.16	2.15
GRE Quantitative Reasoning	High quartile	55%	61%	78%	40%	59%	45%
	Low quartile	38%	38%	47%	16%	30%	19%
	High/low	1.45	1.60	1.65	2.57	1.96	2.34
GRE Analytical Writing	High quartile	58%	55%	74%	42%	64%	46%
	Low quartile	36%	30%	52%	14%	35%	16%
	High/low	1.59	1.82	1.43	3.05	1.85	2.84

Note. CIP = classification of instructional programs.

Table A17 GRE Quartile Comparisons: Master's Seekers

General program area (with its 2-digit CIP code)		Computer & information sciences (11)	Education (13)	Engineering (14)	Engineering technologies & engineering related fields (15)	Foreign languages, literature & linguistics (16)	Family & consumer sciences/ human sciences (19)
k (Total # of universities contributing data)		8	10	7	2	6	2
N (Total # of students contributing data)		278	4,649	1,481	141	238	87
		Probability of grade of C+ or lower					
GRE Verbal Reasoning	Low quartile	32%	17%	33%	62%	18%	19%
	High quartile	19%	12%	30%	46%	6%	17%
	Low/high	1.75	1.40	1.11	1.35	2.82	1.12
GRE Quantitative Reasoning	Low quartile	31%	17%	36%	74%	12%	15%
	High quartile	17%	14%	25%	44%	10%	9%
	Low/high	1.75	1.23	1.43	1.67	1.21	1.61
GRE Analytical Writing	Low quartile	33%	18%	40%	68%	17%	17%
	High quartile	21%	11%	25%	48%	8%	6%
	Low/high	1.60	1.57	1.57	1.42	2.24	2.84
		Probability of cumulative graduate GPA $\geq$ 3.8					
GRE Verbal Reasoning	High quartile	37%	76%	37%	32%	70%	62%
	Low quartile	19%	54%	27%	11%	48%	75%
	High/low	1.94	1.41	1.35	2.97	1.46	0.82
GRE Quantitative Reasoning	High quartile	38%	71%	37%	26%	66%	63%
	Low quartile	23%	55%	25%	6%	52%	70%
	High/low	1.68	1.29	1.46	4.46	1.27	0.89
GRE Analytical Writing	High quartile	42%	76%	39%	32%	73%	76%
	Low quartile	22%	55%	23%	3%	49%	68%
	High/low	1.90	1.39	1.70	10.54	1.48	1.12

Note. CIP = classification of instructional programs.

Table A18 GRE Quartile Comparisons: Master's Seekers

General program area (with its 2-digit CIP code)		English language & literature/ letters (23)	Liberal arts & sciences, general studies & humanities (24)	Library science (25)	Biological & biomedical sciences (26)	Mathematics & statistics (27)	Multi/ interdisciplinary studies (30)
k (Total # of universities contributing data)		9	6	2	9	8	4
N (Total # of students contributing data)		552	118	867	445	230	75
		Probability of grade of C+ or lower					
GRE Verbal Reasoning	Low quartile	12%	28%	20%	22%	45%	31%
	High quartile	6%	12%	15%	13%	31%	20%
	Low/high	2.18	2.35	1.36	1.70	1.43	1.53
GRE Quantitative Reasoning	Low quartile	10%	28%	18%	30%	49%	29%
	High quartile	4%	23%	21%	8%	31%	22%
	Low/high	2.36	1.21	0.87	3.61	1.57	1.30
GRE Analytical Writing	Low quartile	11%	34%	24%	29%	47%	23%
	High quartile	4%	29%	15%	20%	38%	5%
	Low/high	2.76	1.17	1.63	1.49	1.22	4.82
		Probability of cumulative graduate GPA $\geq$ 3.8					
GRE Verbal Reasoning	High quartile	74%	70%	68%	57%	21%	52%
	Low quartile	49%	26%	52%	31%	14%	40%
	High/low	1.51	2.71	1.31	1.84	1.53	1.30
GRE Quantitative Reasoning	High quartile	77%	47%	63%	55%	29%	65%
	Low quartile	55%	32%	58%	28%	7%	32%
	High/low	1.42	1.47	1.10	1.95	4.22	1.99
GRE Analytical Writing	High quartile	75%	57%	73%	48%	23%	68%
	Low quartile	42%	30%	47%	25%	18%	41%
	High/low	1.79	1.88	1.56	1.89	1.27	1.65

Note. CIP = classification of instructional programs.

Table A19 GRE Quartile Comparisons: Master's Seekers

General program area (with its 2-digit CIP code)		Parks, recreation, leisure, & fitness studies (31)	Philosophy & religious studies (38)	Physical sciences (40)	Psychology (42)	Security & protective services (43)	Public administration & social service professions (44)
k (Total # of universities contributing data)		6	5	7	9	7	9
N (Total # of students contributing data)		375	81	240	461	469	1,713
		Probability of grade of C+ or lower					
GRE Verbal Reasoning	Low quartile	39%	10%	19%	12%	28%	22%
	High quartile	29%	5%	20%	6%	18%	11%
	Low/high	1.35	1.96	0.95	2.05	1.59	2.04
GRE Quantitative Reasoning	Low quartile	37%	11%	15%	11%	27%	23%
	High quartile	30%	7%	14%	6%	14%	9%
	Low/high	1.21	1.49	1.02	1.71	1.84	2.67
GRE Analytical Writing	Low quartile	36%	5%	25%	17%	29%	23%
	High quartile	21%	16%	18%	5%	14%	10%
	Low/high	1.76	0.32	1.37	3.47	2.14	2.25
		Probability of cumulative graduate GPA $\geq$ 3.8					
GRE Verbal Reasoning	High quartile	42%	44%	34%	62%	50%	61%
	Low quartile	24%	26%	21%	48%	20%	32%
	High/low	1.76	1.72	1.62	1.28	2.50	1.95
GRE Quantitative Reasoning	High quartile	41%	58%	30%	56%	42%	65%
	Low quartile	30%	26%	31%	54%	32%	34%
	High/low	1.38	2.19	0.98	1.03	1.32	1.89
GRE Analytical Writing	High quartile	44%	52%	33%	59%	46%	65%
	Low quartile	19%	47%	19%	45%	23%	33%
	High/low	2.25	1.11	1.72	1.31	1.99	1.95

Note. CIP = classification of instructional programs.

Table A20 GRE Quartile Comparisons: Master's Seekers

General program area (with its 2-digit CIP code)		Social sciences (45)	Visual & performing arts (50)	Health professions & clinical sciences (51)	Business, management, marketing (52)	History (54)
k (Total # of universities contributing data)		9	6	10	9	8
N (Total # of students contributing data)		1,133	744	3,772	901	289
		Probability of grade of C+ or lower				
GRE Verbal Reasoning	Low quartile	22%	22%	30%	43%	8%
	High quartile	12%	9%	17%	31%	10%
	Low/high	1.81	2.37	1.76	1.39	0.76
GRE Quantitative Reasoning	Low quartile	25%	18%	28%	42%	14%
	High quartile	14%	9%	19%	33%	10%
	Low/high	1.80	1.88	1.45	1.28	1.51
GRE Analytical Writing	Low quartile	24%	17%	30%	45%	9%
	High quartile	14%	9%	18%	33%	11%
	Low/high	1.72	1.79	1.68	1.37	0.83
		Probability of cumulative graduate GPA $\geq$ 3.8				
GRE Verbal Reasoning	High quartile	59%	59%	57%	27%	62%
	Low quartile	21%	47%	33%	13%	28%
	High/low	2.83	1.27	1.71	2.09	2.19
GRE Quantitative Reasoning	High quartile	46%	55%	55%	25%	52%
	Low quartile	26%	48%	36%	19%	39%
	High/low	1.80	1.15	1.54	1.32	1.34
GRE Analytical Writing	High quartile	48%	59%	54%	29%	60%
	Low quartile	27%	48%	36%	17%	30%
	High/low	1.82	1.24	1.52	1.73	1.97

Note. CIP = classification of instructional programs.

Table A21 Zero-Order Correlations Between Cumulative Graduate Grade Point Average (GGPA) and GRE Sections Overall and for All Program Areas: Doctorate Seekers

General program area (with its 2-digit CIP code)		Overall	Agriculture & related sciences (01)	Natural resources & conservation (03)	Architecture & related services (04)	Communication, journalism, related programs (09)	Computer & information sciences (11)
k (Total # of universities contributing data)		10	1	1	2	2	4
N (Total # of students contributing data)		4,229	46	26	13	23	102
Attenuation of ρ_{XY} due to unreliability of criterion (cumulative graduate GPA)	Cronbach's alpha	0.66	0.68	0.75	0.77	0.36	0.76
	Reduction in magnitude of ρ_{XY}	−19%	−18%	−13%	−12%	−40%	−13%
GRE Verbal Reasoning	Mean U_{RR}	1.14	1.04	1.05	1.68	1.81	1.16
	r_{obs}	0.13	−0.04	−0.05	0.36	−0.27	0.02
	r_{urv}	0.15	−0.04	−0.05	0.54	−0.42	0.03
	r_{mrv}	0.16	0.00	−0.05	0.86	−0.44	0.03
	$r_{mrv+UGPA}$	0.19	0.04	−0.03	0.13	−0.51	0.05
GRE Quantitative Reasoning	Mean U_{RR}	1.21	1.24	1.09	1.37	1.37	1.48
	r_{obs}	0.15	0.03	−0.21	0.04	0.20	0.17
	r_{urv}	0.17	0.03	−0.23	0.08	0.26	0.23
	r_{mrv}	0.20	0.07	−0.16	0.69	0.06	0.26
	$r_{mrv+UGPA}$	0.24	0.08	−0.15	0.42	0.01	0.24
GRE Analytical Writing	Mean U_{RR}	1.09	1.22	1.12	0.97	0.98	1.16
	r_{obs}	0.16	0.16	0.21	0.46	0.07	0.02
	r_{urv}	0.16	0.19	0.24	0.45	0.05	0.02
	r_{mrv}	0.17	0.20	0.17	0.42	−0.09	0.00
	$r_{mrv+UGPA}$	0.21	0.22	0.18	0.18	−0.10	0.11

Note. CIP = classification of instructional programs.

Table A22 Zero-Order Correlations Between Cumulative Graduate Grade Point Average (GGPA) and GRE Sections Overall and for All Program Areas: Doctorate Seekers

General program area (with its 2-digit CIP code)		Education (13)	Engineering (14)	Foreign languages, literature, & linguistics (16)	Family & consumer sciences/ human sciences (19)	English language & literature/ letters (23)
k (Total # of universities contributing data)		8	6	3	1	4
N (Total # of students contributing data)		539	670	50	12	137
Attenuation of ρ_{XY} due to unreliability of criterion (cumulative graduate GPA)	Cronbach's alpha	0.65	0.62	0.68	0.57	0.59
	Reduction in magnitude of ρ_{XY}	−20%	−21%	−17%	−24%	−24%
GRE Verbal Reasoning	Mean U_{RR}	1.04	1.22	0.95	0.83	1.23
	r_{obs}	0.18	0.04	0.10	0.48	0.01
	r_{urv}	0.18	0.05	0.09	0.41	0.00
	r_{mrv}	0.21	0.04	0.23	0.13	0.03
	$r_{mrv+UGPA}$	0.23	0.08	0.24	0.10	0.09
GRE Quantitative Reasoning	Mean U_{RR}	1.06	1.10	1.21	1.24	1.04
	r_{obs}	0.19	0.14	0.35	−0.36	0.06
	r_{urv}	0.20	0.15	0.37	−0.44	0.05
	r_{mrv}	0.29	0.21	0.39	−0.53	0.07
	$r_{mrv+UGPA}$	0.30	0.24	0.32	−0.53	0.10
GRE Analytical Writing	Mean U_{RR}	1.03	1.09	1.08	0.90	1.20
	r_{obs}	0.15	0.06	0.22	0.04	0.07
	r_{urv}	0.15	0.06	0.23	0.04	0.07
	r_{mrv}	0.17	0.07	0.28	−0.37	0.01
	$r_{mrv+UGPA}$	0.19	0.10	0.28	−0.35	0.11

Note. CIP = classification of instructional programs.

Table A23 Zero-Order Correlations Between Cumulative Graduate Grade Point Average (GGPA) and GRE Sections Overall and for All Program Areas: Doctorate Seekers

General program area (with its 2-digit CIP code)		Liberal arts & sciences, general studies & humanities (24)	Library science (25)	Biological & biomedical sciences (26)	Mathematics & statistics (27)	Multi/ interdisciplinary studies (30)
k (Total # of universities contributing data)		1	1	6	5	4
N (Total # of students contributing data)		20	9	446	122	56
Attenuation of ρ_{XY} due to unreliability of criterion (cumulative graduate GPA)	Cronbach's alpha	0.31	0.07	0.61	0.57	0.61
	Reduction in magnitude of ρ_{XY}	−44%	−73%	−22%	−24%	−22%
GRE Verbal Reasoning	Mean U_{RR}	1.00	0.88	1.17	1.09	1.07
	r_{obs}	0.59	0.25	0.24	0.03	0.25
	r_{urv}	0.59	0.22	0.28	0.02	0.25
	r_{mrv}	0.55	0.27	0.27	0.19	0.15
	$r_{mrv+UGPA}$	0.54	0.28	0.30	0.20	0.14
GRE Quantitative Reasoning	Mean U_{RR}	0.96	1.16	1.22	1.48	1.30
	r_{obs}	0.47	0.17	0.16	0.29	0.05
	r_{urv}	0.45	0.20	0.19	0.39	0.07
	r_{mrv}	0.46	0.28	0.20	0.40	0.13
	$r_{mrv+UGPA}$	0.44	0.33	0.22	0.41	0.15
GRE Analytical Writing	Mean U_{RR}	0.79	0.81	1.12	1.27	1.12
	r_{obs}	0.69	0.23	0.23	0.02	0.11
	r_{urv}	0.60	0.19	0.26	0.05	0.13
	r_{mrv}	0.64	0.21	0.27	0.15	0.12
	$r_{mrv+UGPA}$	0.65	0.23	0.27	0.18	0.14

Note. CIP = classification of instructional programs.

Table A24 Zero-Order Correlations Between Cumulative Graduate Grade Point Average (GGPA) and GRE Sections Overall and for All Program Areas: Doctorate Seekers

General program area (with its 2-digit CIP code)		Parks, recreation, leisure, & fitness studies (31)	Philosophy & religious studies (38)	Physical sciences (40)	Psychology (42)	Security & protective services (43)	Public administration & social service professions (44)
k (Total # of universities contributing data)		1	3	7	6	1	5
N (Total # of students contributing data)		25	106	508	417	26	70
Attenuation of ρ_{XY} due to unreliability of criterion (cumulative graduate GPA)	Cronbach's alpha	0.68	0.73	0.72	0.65	0.82	0.66
	Reduction in magnitude of ρ_{XY}	−17%	−14%	−15%	−19%	−10%	−18%
GRE Verbal Reasoning	Mean U_{RR}	1.36	1.37	1.09	1.22	0.90	0.93
	r_{obs}	0.33	0.19	0.04	0.17	0.41	0.26
	r_{urv}	0.43	0.24	0.05	0.21	0.38	0.24
	r_{mrv}	0.69	0.12	0.07	0.24	0.39	0.32
	$r_{mrv+UGPA}$	0.69	0.18	0.07	0.27	0.39	0.32
GRE Quantitative Reasoning	Mean U_{RR}	1.14	1.14	1.18	1.46	1.21	1.25
	r_{obs}	0.41	−0.18	0.18	0.24	−0.04	0.08
	r_{urv}	0.45	−0.23	0.21	0.31	−0.05	0.06
	r_{mrv}	0.68	−0.22	0.22	0.32	0.12	0.12
	$r_{mrv+UGPA}$	0.69	−0.13	0.21	0.39	0.15	0.27
GRE Analytical Writing	Mean U_{RR}	1.06	1.17	1.09	1.04	0.87	1.09
	r_{obs}	0.17	0.09	0.17	0.24	0.38	0.34
	r_{urv}	0.18	0.11	0.19	0.25	0.34	0.35
	r_{mrv}	0.38	0.08	0.18	0.28	0.36	0.27
	$r_{mrv+UGPA}$	0.37	0.14	0.18	0.32	0.46	0.32

Note. CIP = classification of instructional programs.

Table A25 Zero-Order Correlations Between Cumulative Graduate Grade Point Average (GGPA) and GRE Sections Overall and for All Program Areas: Doctorate Seekers

General program area (with its 2-digit CIP code)		Social sciences (45)	Visual & performing arts (50)	Health professions & clinical sciences (51)	Business, management, marketing (52)	History (54)
k (Total # of universities contributing data)		5	3	8	4	3
N (Total # of students contributing data)		326	38	337	16	89
Attenuation of ρ_{XY} due to unreliability of criterion (cumulative graduate GPA)	Cronbach's alpha	0.77	0.35	0.71	0.45	0.66
	Reduction in magnitude of ρ_{XY}	−12%	−41%	−16%	−33%	−19%
GRE Verbal Reasoning	Mean U_{RR}	1.08	1.39	1.09	2.11	1.11
	r_{obs}	0.16	0.40	0.10	−0.12	0.44
	r_{urv}	0.17	0.48	0.12	−0.06	0.49
	r_{mrv}	0.18	0.30	0.12	−0.20	0.47
	$r_{mrv+UGPA}$	0.21	0.30	0.15	N/A	0.47
GRE Quantitative Reasoning	Mean U_{RR}	1.36	1.14	1.16	1.47	1.10
	r_{obs}	0.03	−0.08	0.18	−0.36	0.21
	r_{urv}	0.04	−0.10	0.20	−0.42	0.24
	r_{mrv}	0.08	−0.21	0.22	−0.55	0.24
	$r_{mrv+UGPA}$	0.10	−0.18	0.24	N/A	0.22
GRE Analytical Writing	Mean U_{RR}	1.10	1.12	1.02	1.45	1.14
	r_{obs}	0.19	−0.02	0.17	−0.12	0.20
	r_{urv}	0.20	−0.10	0.17	−0.16	0.22
	r_{mrv}	0.21	0.16	0.20	−0.22	0.25
	$r_{mrv+UGPA}$	0.23	0.20	0.23	N/A	0.29

Note. CIP = classification of instructional programs.

Table A26 Multivariate Analyses of Variables' Importance Based on Observed Data (No Adjustments for Range Variation): Doctorate Seekers

General program area (with its 2-digit CIP code)		Overall	Agriculture & related sciences (01)	Natural resources & conservation (03)	Architecture & related services (04)	Communication, journalism, related programs (09)	Computer & information sciences (11)	Education (13)
k (Total # of universities contributing data)		10	1	1	2	2	4	8
N (Total # of students contributing data)		4,229	46	26	13	23	102	539
Model R (R^2)	R (R^2)	0.37 (0.13)	0.20 (0.04)	0.32 (0.10)	0.77 (0.59)	0.52 (0.27)	0.32 (0.10)	0.33 (0.11)
	R_{+UGPA} (R^2_{+UGPA})	0.46 (0.21)	0.27 (0.07)	0.34 (0.11)	0.78 (0.62)	0.52 (0.27)	0.43 (0.18)	0.37 (0.14)
ΔR^2 over UGPA	GRE V + Q + AW	0.15	0.02	0.11	0.61	0.27	0.17	0.12
	GRE Verbal Reasoning	0.05	0.00	0.00	0.13	0.13	0.02	0.06
	GRE Quantitative Reasoning	0.05	0.00	0.05	0.16	0.08	0.06	0.05
	GRE Analytical Writing	0.05	0.02	0.05	0.19	0.02	0.07	0.04
GRE Verbal Reasoning	β	0.06	−0.14	0.00	1.15	−0.44	0.03	0.10
	β_{+UGPA}	0.04	−0.09	0.00	0.49	−0.50	−0.02	0.10
	$\%C_{xj}$	30%	21%	3%	36%	60%	27%	24%
	$\%C_{xj+UGPA}$	17%	8%	3%	25%	60%	17%	21%
GRE Quantitative Reasoning	β	0.12	0.03	−0.24	0.93	0.29	0.23	0.17
	β_{+UGPA}	0.11	0.00	−0.25	0.81	0.29	0.16	0.17
	$\%C_{xj}$	34%	2%	47%	21%	27%	61%	40%
	$\%C_{xj+UGPA}$	21%	1%	44%	21%	28%	58%	24%
GRE Analytical Writing	β	0.11	0.21	0.25	0.20	0.20	−0.04	0.07
	β_{+UGPA}	0.11	0.18	0.25	0.50	0.26	0.07	0.07
	$\%C_{xj}$	35%	77%	52%	40%	13%	13%	35%
	$\%C_{xj+UGPA}$	21%	35%	48%	31%	12%	9%	31%
UGPA	β	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	β_{+UGPA}	0.22	0.19	0.10	−0.42	−0.07	0.15	0.13
	$\%C_{xj}$	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	$\%C_{xj+UGPA}$	40%	59%	7%	28%	4%	19%	23%

Note. CIP = classification of instructional programs; UGPA = undergraduate grade point average; V = Verbal; Q = Quantitative; AW = Analytical Writing.

Table A27 Multivariate Analyses of Variables' Importance Based on Observed Data (No Adjustments for Range Variation): Doctorate Seekers

General program area (with its 2-digit CIP code)		Engineering (14)	Foreign languages, literature, & linguistics (16)	Family & consumer sciences/ human sciences (19)	English language & literature/ letters (23)	Liberal arts & sciences, general studies & humanities (24)
k (Total # of universities contributing data)		6	3	1	4	1
N (Total # of students contributing data)		670	50	12	137	20
Model R (R^2)	R (R^2)	0.26 (0.07)	0.55 (0.30)	0.76 (0.57)	0.37 (0.14)	0.75 (0.56)
	R_{+UGPA} (R^2_{+UGPA})	0.44 (0.20)	0.68 (0.46)	0.82 (0.67)	0.48 (0.23)	0.76 (0.58)
ΔR^2 over UGPA	GRE V + Q + AW	0.07	0.36	0.66	0.21	0.51
	GRE Verbal Reasoning	0.01	0.03	0.22	0.06	0.30
	GRE Quantitative Reasoning	0.03	0.16	0.21	0.04	0.18
	GRE Analytical Writing	0.01	0.06	0.00	0.09	0.44
GRE Verbal Reasoning	β	−0.03	−0.14	0.79	−0.02	0.21
	β_{+UGPA}	−0.01	−0.07	0.76	−0.01	0.16
	$\%C_{xj}$	32%	16%	49%	33%	27%
	$\%C_{xj+UGPA}$	6%	9%	41%	17%	24%
GRE Quantitative Reasoning	β	0.15	0.35	−0.61	0.08	0.24
	β_{+UGPA}	0.09	0.31	−0.84	0.07	0.24
	$\%C_{xj}$	38%	52%	30%	19%	18%
	$\%C_{xj+UGPA}$	20%	39%	32%	13%	17%
GRE Analytical Writing	β	0.06	0.08	−0.66	0.05	0.47
	β_{+UGPA}	0.03	0.07	−0.76	0.07	0.61
	$\%C_{xj}$	28%	28%	14%	47%	49%
	$\%C_{xj+UGPA}$	4%	8%	14%	36%	47%
UGPA	β	N/A	N/A	N/A	N/A	N/A
	β_{+UGPA}	0.35	0.23	0.37	0.12	−0.18
	$\%C_{xj}$	N/A	N/A	N/A	N/A	N/A
	$\%C_{xj+UGPA}$	69%	40%	7%	33%	5%

Note. CIP = classification of instructional programs; UGPA = undergraduate grade point average; V = Verbal; Q = Quantitative; AW = Analytical Writing.

Table A28 Multivariate Analyses of Variables' Importance Based on Observed Data (No Adjustments for Range Variation): Doctorate Seekers

General program area (with its 2-digit CIP code)		Library science (25)	Biological & biomedical sciences (26)	Mathematics & statistics (27)	Multi/ interdisciplinary studies (30)	Parks, recreation, leisure, & fitness studies (31)
k (Total # of universities contributing data)		1	6	5	4	1
N (Total # of students contributing data)		9	446	122	56	25
Model R (R^2)	R (R^2)	0.30 (0.09)	0.35 (0.12)	0.41 (0.17)	0.42 (0.18)	0.62 (0.39)
	R_{+UGPA} (R^2_{+UGPA})	0.34 (0.12)	0.41 (0.17)	0.51 (0.26)	0.51 (0.26)	0.63 (0.39)
ΔR^2 over UGPA	GRE V + Q + AW	0.12	0.10	0.23	0.24	0.39
	GRE Verbal Reasoning	0.06	0.05	0.04	0.05	0.11
	GRE Quantitative Reasoning	0.03	0.03	0.10	0.03	0.17
	GRE Analytical Writing	0.05	0.05	0.05	0.03	0.03
GRE Verbal Reasoning	β	0.18	0.16	0.04	0.13	0.48
	β_{+UGPA}	0.16	0.16	0.01	0.05	0.49
	$\%C_{xj}$	40%	36%	25%	51%	38%
	$\%C_{xj+UGPA}$	32%	25%	15%	34%	38%

Table A28 Continued

General program area (with its 2-digit CIP code)		Library science (25)	Biological & biomedical sciences (26)	Mathematics & statistics (27)	Multi/ interdisciplinary studies (30)	Parks, recreation, leisure, & fitness studies (31)
GRE Quantitative	β	0.17	0.09	0.28	−0.05	0.55
Reasoning	β_{+UGPA}	0.28	0.07	0.25	−0.04	0.56
	$\%C_{xj}$	30%	20%	60%	28%	58%
	$\%C_{xj+UGPA}$	31%	13%	39%	24%	57%
GRE Analytical	β	0.08	0.16	0.00	0.14	0.04
Writing	β_{+UGPA}	0.17	0.12	0.01	0.13	0.02
	$\%C_{xj}$	30%	41%	14%	21%	6%
	$\%C_{xj+UGPA}$	26%	24%	11%	12%	5%
UGPA	β	N/A	N/A	N/A	N/A	N/A
	β_{+UGPA}	−0.21	0.21	0.19	0.14	0.07
	$\%C_{xj}$	N/A	N/A	N/A	N/A	N/A
	$\%C_{xj+UGPA}$	9%	35%	36%	29%	0%

Note. CIP = classification of instructional programs; UGPA = undergraduate grade point average; V = Verbal; Q = Quantitative; AW = Analytical Writing.

Table A29 Multivariate Analyses of Variables' Importance Based on Observed Data (No Adjustments for Range Variation): Doctorate Seekers

General program area (with its 2-digit CIP code)		Philosophy & religious studies (38)	Physical sciences (40)	Psychology (42)	Security & protective services (43)	Public administration & social service professions (44)
k (Total # of universities contributing data)		3	7	6	1	5
N (Total # of students contributing data)		106	508	417	26	70
Model R (R^2)	R (R^2)	0.44 (0.19)	0.31 (0.09)	0.37 (0.14)	0.50 (0.25)	0.62 (0.38)
	R_{+UGPA} (R^2_{+UGPA})	0.53 (0.28)	0.38 (0.15)	0.53 (0.28)	0.59 (0.34)	0.68 (0.46)
ΔR^2 over UGPA	GRE V + Q + AW	0.15	0.09	0.13	0.27	0.46
	GRE Verbal Reasoning	0.07	0.02	0.02	0.14	0.17
	GRE Quantitative Reasoning	0.06	0.02	0.07	0.00	0.08
	GRE Analytical Writing	0.05	0.03	0.05	0.20	0.18
GRE Verbal	β	0.18	−0.07	0.02	0.36	0.15
Reasoning	β_{+UGPA}	0.14	−0.08	−0.04	0.29	−0.11
	$\%C_{xj}$	52%	19%	18%	55%	36%
	$\%C_{xj+UGPA}$	23%	14%	6%	36%	32%
GRE Quantitative	β	−0.27	0.18	0.20	−0.09	0.07
Reasoning	β_{+UGPA}	−0.20	0.14	0.22	−0.10	0.54
	$\%C_{xj}$	28%	36%	41%	3%	17%
	$\%C_{xj+UGPA}$	19%	18%	22%	2%	16%
GRE Analytical	β	0.07	0.17	0.19	0.27	0.28
Writing	β_{+UGPA}	0.08	0.16	0.17	0.35	0.39
	$\%C_{xj}$	19%	43%	38%	43%	45%
	$\%C_{xj+UGPA}$	13%	29%	18%	39%	41%
UGPA	β	N/A	N/A	N/A	N/A	N/A
	β_{+UGPA}	0.29	0.21	0.36	0.31	−0.19
	$\%C_{xj}$	N/A	N/A	N/A	N/A	N/A
	$\%C_{xj+UGPA}$	46%	37%	52%	25%	9%

Note. CIP = classification of instructional programs; UGPA = undergraduate grade point average; V = Verbal; Q = Quantitative; AW = Analytical Writing.

Table A30 Multivariate Analyses of Variables' Importance Based on Observed Data (No Adjustments for Range Variation): Doctorate Seekers

General program area (with its 2-digit CIP code)		Social sciences (45)	Visual & performing arts (50)	Health professions & clinical sciences (51)	Business, management, marketing (52)	History (54)
k (Total # of universities contributing data)		5	3	8	4	3
N (Total # of students contributing data)		326	38	337	16	89
Model R (R^2)	R (R^2)	0.29 (0.08)	0.60 (0.36)	0.40 (0.16)	1.00 (1.00)	0.49 (0.24)
	R_{+UGPA} (R^2_{+UGPA})	0.39 (0.15)	0.63 (0.40)	0.45 (0.20)	1.00 (1.00)	0.55 (0.30)
ΔR^2 over UGPA	GRE V + Q + AW	0.08	0.37	0.17	0.86	0.29
	GRE Verbal Reasoning	0.03	0.23	0.05	0.27	0.20
	GRE Quantitative Reasoning	0.01	0.03	0.09	0.27	0.07
	GRE Analytical Writing	0.02	0.10	0.04	0.30	0.08
GRE Verbal Reasoning	β	0.10	0.46	−0.02	0.38	0.40
	β_{+UGPA}	0.10	0.50	−0.03	−0.65	0.35
	$\%C_{xj}$	28%	47%	32%	32%	74%
	$\%C_{xj+UGPA}$	15%	43%	22%	24%	59%
GRE Quantitative Reasoning	β	−0.02	−0.29	0.17	−1.35	0.00
	β_{+UGPA}	−0.04	−0.38	0.14	−0.55	−0.04
	$\%C_{xj}$	15%	34%	45%	32%	13%
	$\%C_{xj+UGPA}$	8%	30%	25%	24%	12%
GRE Analytical Writing	β	0.14	0.02	0.15	−0.62	0.09
	β_{+UGPA}	0.12	0.06	0.14	0.31	0.16
	$\%C_{xj}$	56%	26%	22%	36%	12%
	$\%C_{xj+UGPA}$	33%	23%	16%	27%	10%
UGPA	β	N/A	N/A	N/A	N/A	N/A
	β_{+UGPA}	0.23	0.05	0.18	0.27	0.18
	$\%C_{xj}$	N/A	N/A	N/A	N/A	N/A
	$\%C_{xj+UGPA}$	42%	10%	36%	46%	18%

Note. CIP = classification of instructional programs; UGPA = undergraduate grade point average; V = Verbal; Q = Quantitative; AW = Analytical Writing.

Table A31 Multivariate Analyses of Variables' Importance Based on Observed Data (Adjusted for Multivariate Range Variation): Doctorate Seekers

General program area (with its 2-digit CIP code)		Overall	Agriculture & related sciences (01)	Natural resources & conservation (03)	Architecture & related services (04)	Communication, journalism, related programs (09)	Computer & information sciences (11)
k (Total # of universities contributing data)		10	1	1	2	2	4
N (Total # of students contributing data)		4,229	46	26	13	23	102
Model R (R^2)	R (R^2)	0.47 (0.22)	0.23 (0.05)	0.30 (0.09)	0.96 (0.92)	0.69 (0.48)	0.45 (0.20)
	R_{+UGPA} (R^2_{+UGPA})	0.55 (0.30)	0.32 (0.10)	0.32 (0.10)	0.79 (0.62)	0.71 (0.50)	0.57 (0.33)
ΔR^2 over UGPA	GRE V + Q + AW	0.12	0.02	0.11	0.49	0.27	0.12
	GRE Verbal Reasoning	0.05	0.00	0.00	N/A	0.30	0.05
	GRE Quantitative Reasoning	0.07	0.00	0.03	N/A	0.10	0.09
	GRE Analytical Writing	0.05	0.03	0.03	N/A	0.07	0.06
GRE Verbal Reasoning	$\%C_{xj}$	27%	16%	5%	66%	61%	24%
	$\%C_{xj+UGPA}$	16%	3%	5%	N/A	67%	15%
GRE Quantitative Reasoning	$\%C_{xj}$	40%	4%	43%	32%	26%	68%
	$\%C_{xj+UGPA}$	22%	1%	37%	N/A	17%	60%
GRE Analytical Writing	$\%C_{xj}$	33%	80%	52%	2%	12%	8%
	$\%C_{xj+UGPA}$	20%	36%	51%	N/A	14%	12%
UGPA	$\%C_{xj}$	N/A	N/A	N/A	N/A	N/A	N/A
	$\%C_{xj+UGPA}$	42%	60%	8%	N/A	2%	13%

Note. CIP = classification of instructional programs; UGPA = undergraduate grade point average; V = Verbal; Q = Quantitative; AW = Analytical Writing.

Table A32 Multivariate Analyses of Variables' Importance Based on Observed Data (Adjusted for Multivariate Range Variation): Doctorate Seekers

General program area (with its 2-digit CIP code)		Education (13)	Engineering (14)	Foreign languages, literature, & linguistics (16)	Family & consumer sciences/ human sciences (19)	English language & literature/ letters (23)
k (Total # of universities contributing data)		8	6	3	1	4
N (Total # of students contributing data)		539	670	50	12	137
Model R (R^2)	R (R^2)	0.41 (0.17)	0.35 (0.12)	0.50 (0.25)	0.82 (0.67)	0.46 (0.21)
	R_{+UGPA} (R^2_{+UGPA})	0.47 (0.22)	0.51 (0.26)	0.74 (0.54)	0.90 (0.81)	0.58 (0.33)
ΔR^2 over UGPA	GRE V + Q + AW	0.10	0.06	0.22	0.66	0.13
	GRE Verbal Reasoning	0.06	0.01	0.03	0.00	0.08
	GRE Quantitative Reasoning	0.07	0.05	0.21	0.43	0.04
	GRE Analytical Writing	0.04	0.02	0.05	0.15	0.10
GRE Verbal Reasoning	$\%C_{xj}$	24%	31%	12%	23%	36%
	$\%C_{xj+UGPA}$	21%	6%	7%	12%	14%
GRE Quantitative Reasoning	$\%C_{xj}$	43%	41%	54%	51%	17%
	$\%C_{xj+UGPA}$	24%	22%	44%	47%	10%
GRE Analytical Writing	$\%C_{xj}$	33%	28%	34%	26%	48%
	$\%C_{xj+UGPA}$	31%	5%	5%	21%	32%
UGPA	$\%C_{xj}$	N/A	N/A	N/A	N/A	N/A
	$\%C_{xj+UGPA}$	24%	67%	44%	20%	44%

Note. CIP = classification of instructional programs; UGPA = undergraduate grade point average; V = Verbal; Q = Quantitative; AW = Analytical Writing.

Table A33 Multivariate Analyses of Variables' Importance Based on Observed Data (Adjusted for Multivariate Range Variation): Doctorate Seekers

General program area (with its 2-digit CIP code)		Liberal arts & sciences, general studies & humanities (24)	Library science (25)	Biological & biomedical sciences (26)	Mathematics & statistics (27)	Multi/ interdisciplinary studies (30)
k (Total # of universities contributing data)		1	1	6	5	4
N (Total # of students contributing data)		20	9	446	122	56
Model R (R^2)	R (R^2)	0.71 (0.50)	0.33 (0.11)	0.40 (0.16)	0.52 (0.27)	0.52 (0.27)
	R_{+UGPA} (R^2_{+UGPA})	0.73 (0.53)	0.45 (0.21)	0.47 (0.22)	0.59 (0.34)	0.59 (0.35)
ΔR^2 over UGPA	GRE V + Q + AW	0.51	0.12	0.10	0.15	0.13
	GRE Verbal Reasoning	0.27	0.10	0.06	0.04	0.03
	GRE Quantitative Reasoning	0.18	0.15	0.04	0.14	0.08
	GRE Analytical Writing	0.43	0.08	0.06	0.03	0.05
GRE Verbal Reasoning	$\%C_{xj}$	26%	38%	36%	18%	47%
	$\%C_{xj+UGPA}$	24%	20%	26%	11%	26%
GRE Quantitative Reasoning	$\%C_{xj}$	21%	50%	21%	73%	30%
	$\%C_{xj+UGPA}$	16%	39%	13%	45%	28%
GRE Analytical Writing	$\%C_{xj}$	53%	11%	43%	10%	23%
	$\%C_{xj+UGPA}$	57%	13%	26%	9%	17%
UGPA	$\%C_{xj}$	N/A	N/A	N/A	N/A	N/A
	$\%C_{xj+UGPA}$	3%	27%	35%	36%	30%

Note. CIP = classification of instructional programs; UGPA = undergraduate grade point average; V = Verbal; Q = Quantitative; AW = Analytical Writing.

Table A34 Multivariate Analyses of Variables' Importance Based on Observed Data (Adjusted for Multivariate Range Variation): Doctorate Seekers

General program area (with its 2-digit CIP code)		Parks, recreation, leisure, & fitness studies (31)	Philosophy & religious studies (38)	Physical sciences (40)	Psychology (42)	Security & protective services (43)
k (Total # of universities contributing data)		1	3	7	6	1
N (Total # of students contributing data)		25	106	508	417	26
Model R (R^2)	R (R^2)	0.80 (0.64)	0.46 (0.21)	0.32 (0.11)	0.43 (0.18)	0.45 (0.20)
	R_{+UGPA} (R^2_{+UGPA})	0.81 (0.66)	0.55 (0.30)	0.42 (0.17)	0.63 (0.39)	0.60 (0.36)
ΔR^2 over UGPA	GRE V + Q + AW	0.39	0.14	0.08	0.11	0.27
	GRE Verbal Reasoning	0.45	0.08	0.02	0.03	0.11
	GRE Quantitative Reasoning	0.44	0.06	0.03	0.11	0.01
	GRE Analytical Writing	0.12	0.05	0.03	0.05	0.14
GRE Verbal Reasoning	$\%C_{xj}$	47%	35%	16%	16%	57%
	$\%C_{xj+UGPA}$	49%	27%	12%	5%	23%
GRE Quantitative Reasoning	$\%C_{xj}$	50%	37%	45%	55%	3%
	$\%C_{xj+UGPA}$	44%	17%	19%	23%	1%
GRE Analytical Writing	$\%C_{xj}$	3%	28%	39%	30%	40%
	$\%C_{xj+UGPA}$	5%	13%	26%	12%	35%
UGPA	$\%C_{xj}$	N/A	N/A	N/A	N/A	N/A
	$\%C_{xj+UGPA}$	1%	43%	43%	59%	40%

Note. CIP = classification of instructional programs; UGPA = undergraduate grade point average; V = Verbal; Q = Quantitative; AW = Analytical Writing.

Table A35 Multivariate Analyses of Variables' Importance Based on Observed Data (Adjusted for Multivariate Range Variation): Doctorate Seekers

General program area (with its 2-digit CIP code)		Public administration & social service professions (44)	Social sciences (45)	Visual & performing arts (50)	Health professions & clinical sciences (51)	Business, management, marketing (52)	History (54)
k (Total # of universities contributing data)		5	5	3	8	4	3
N (Total # of students contributing data)		70	326	38	337	16	89
Model R (R^2)	R (R^2)	0.65 (0.42)	0.36 (0.13)	0.61 (0.38)	0.43 (0.18)	1.00 (1.00)	0.53 (0.28)
	R_{+UGPA} (R^2_{+UGPA})	0.73 (0.53)	0.47 (0.22)	0.63 (0.39)	0.53 (0.28)	N/A (N/A)	0.61 (0.37)
ΔR^2 over UGPA	GRE V + Q + AW	0.43	0.05	0.36	0.16	0.47	0.26
	GRE Verbal Reasoning	0.06	0.03	0.23	0.06	N/A	0.21
	GRE Quantitative Reasoning	0.12	0.02	0.10	0.12	N/A	0.07
	GRE Analytical Writing	0.14	0.03	0.03	0.07	N/A	0.09
GRE Verbal Reasoning	$\%C_{xj}$	32%	26%	49%	18%	N/A	74%
	$\%C_{xj+UGPA}$	22%	15%	35%	13%	N/A	58%
GRE Quantitative Reasoning	$\%C_{xj}$	30%	21%	41%	60%	N/A	12%
	$\%C_{xj+UGPA}$	30%	9%	36%	36%	N/A	9%
GRE Analytical Writing	$\%C_{xj}$	38%	53%	10%	21%	N/A	14%
	$\%C_{xj+UGPA}$	40%	31%	10%	18%	N/A	13%
UGPA	$\%C_{xj}$	N/A	N/A	N/A	N/A	N/A	N/A
	$\%C_{xj+UGPA}$	8%	45%	20%	33%	N/A	20%

Note. CIP = classification of instructional programs; UGPA = undergraduate grade point average; V = Verbal; Q = Quantitative; AW = Analytical Writing.

Table A36 GRE Quartile Comparisons: Doctorate Seekers

General program area (with its 2-digit CIP code)		Overall	Agriculture & related sciences (01)	Natural resources & conservation (03)	Architecture & related services (04)	Communication, journalism, related programs (09)	Computer & information sciences (11)
k (Total # of universities contributing data)		10	1	1	2	2	4
N (Total # of students contributing data)		4,229	46	26	13	23	102
		Probability of grade of C+ or lower					
GRE Verbal Reasoning	Low quartile	22%	36%	0%	0%	0%	21%
	High quartile	14%	25%	0%	27%	20%	5%
	Low/high	1.49	1.45	N/A	0.00	0.00	4.23
GRE Quantitative Reasoning	Low quartile	21%	45%	0%	0%	0%	17%
	High quartile	15%	18%	14%	0%	0%	13%
	Low/high	1.47	2.50	0.00	N/A	N/A	1.29
GRE Analytical Writing	Low quartile	22%	67%	20%	0%	0%	17%
	High quartile	13%	33%	0%	0%	20%	6%
	Low/high	1.64	2.00	N/A	N/A	0.00	2.79
		Probability of cumulative graduate GPA ≥ 3.8					
GRE Verbal Reasoning	High quartile	62%	42%	86%	73%	67%	61%
	Low quartile	43%	36%	100%	0%	64%	54%
	High/low	1.45	1.15	0.86	N/A	1.05	1.13
GRE Quantitative Reasoning	High quartile	60%	64%	71%	73%	82%	60%
	Low quartile	43%	27%	100%	54%	64%	34%
	High/low	1.37	2.33	0.71	1.36	1.29	1.75
GRE Analytical Writing	High quartile	60%	44%	100%	100%	79%	56%
	Low quartile	44%	33%	80%	0%	64%	59%
	High/low	1.35	1.33	1.25	N/A	1.24	0.95

Note. CIP = classification of instructional programs.

Table A37 GRE Quartile Comparisons: Doctorate Seekers

General program area (with its 2-digit CIP code)		Education (13)	Engineering (14)	Foreign languages, literature, & linguistics (16)	Family & consumer sciences/ human sciences (19)	English language & literature/ letters (23)
k (Total # of universities contributing data)		8	6	3	1	4
N (Total # of students contributing data)		539	670	50	12	137
		Probability of grade of C+ or lower				
GRE Verbal Reasoning	Low quartile	16%	34%	10%	0%	0%
	High quartile	8%	25%	6%	0%	6%
	Low/high	1.90	1.40	1.63	N/A	0.00
GRE Quantitative Reasoning	Low quartile	22%	25%	9%	33%	0%
	High quartile	9%	23%	0%	0%	3%
	Low/high	2.40	1.09	N/A	N/A	0.00
GRE Analytical Writing	Low quartile	13%	32%	7%	0%	0%
	High quartile	11%	22%	6%	0%	5%
	Low/high	1.19	1.45	1.22	N/A	0.00
		Probability of cumulative graduate GPA ≥ 3.8				
GRE Verbal Reasoning	High quartile	83%	46%	85%	50%	94%
	Low quartile	58%	32%	50%	33%	88%
	High/low	1.43	1.42	1.70	1.50	1.07
GRE Quantitative Reasoning	High quartile	82%	51%	86%	33%	88%
	Low quartile	53%	35%	55%	50%	83%
	High/low	1.54	1.46	1.57	0.67	1.06
GRE Analytical Writing	High quartile	77%	49%	85%	0%	92%
	Low quartile	63%	41%	70%	50%	89%
	High/low	1.22	1.21	1.23	0.00	1.04

Note. CIP = classification of instructional programs.

Table A38 GRE Quartile Comparisons: Doctorate Seekers

General program area (with its 2-digit CIP code)		Liberal arts & sciences, general studies & humanities (24)	Library science (25)	Biological & biomedical sciences (26)	Mathematics & statistics (27)	Multi/ interdisciplinary studies (30)
k (Total # of universities contributing data)		1	1	6	5	4
N (Total # of students contributing data)		20	9	446	122	56
		Probability of grade of C+ or lower				
GRE Verbal Reasoning	Low quartile	20%	0%	27%	55%	8%
	High quartile	0%	0%	10%	25%	22%
	Low/high	N/A	N/A	2.80	2.21	0.38
GRE Quantitative Reasoning	Low quartile	40%	0%	23%	56%	0%
	High quartile	0%	0%	12%	29%	14%
	Low/high	N/A	N/A	1.95	1.93	0.00
GRE Analytical Writing	Low quartile	50%	0%	21%	38%	16%
	High quartile	0%	0%	8%	44%	11%
	Low/high	N/A	N/A	2.48	0.86	1.47
		Probability of cumulative graduate GPA $\geq$ 3.8				
GRE Verbal Reasoning	High quartile	100%	100%	56%	35%	55%
	Low quartile	40%	100%	39%	24%	31%
	High/low	2.50	1.00	1.43	1.43	1.78
GRE Quantitative Reasoning	High quartile	100%	50%	55%	36%	46%
	Low quartile	60%	100%	39%	10%	52%
	High/low	1.67	0.50	1.39	3.42	0.88
GRE Analytical Writing	High quartile	100%	100%	58%	20%	47%
	Low quartile	25%	50%	36%	25%	44%
	High/low	4.00	2.00	1.62	0.79	1.07

Note. CIP = classification of instructional programs.

Table A39 GRE Quartile Comparisons: Doctorate Seekers

General program area (with its 2-digit CIP code)		Parks, recreation, leisure, & fitness studies (31)	Philosophy & religious studies (38)	Physical sciences (40)	Psychology (42)	Security & protective services (43)
k (Total # of universities contributing data)		1	3	7	6	1
N (Total # of students contributing data)		25	106	508	417	26
		Probability of grade of C+ or lower				
GRE Verbal Reasoning	Low quartile	33%	17%	23%	10%	33%
	High quartile	14%	4%	25%	8%	0%
	Low/high	2.33	3.75	0.90	1.34	N/A
GRE Quantitative Reasoning	Low quartile	40%	12%	33%	11%	33%
	High quartile	17%	16%	24%	6%	0%
	Low/high	2.40	0.74	1.40	1.95	N/A
GRE Analytical Writing	Low quartile	25%	11%	34%	18%	40%
	High quartile	0%	8%	17%	9%	29%
	Low/high	N/A	1.38	2.04	1.94	1.40
		Probability of cumulative graduate GPA $\geq$ 3.8				
GRE Verbal Reasoning	High quartile	86%	71%	38%	76%	50%
	Low quartile	67%	34%	26%	56%	0%
	High/low	1.29	2.06	1.48	1.36	N/A
GRE Quantitative Reasoning	High quartile	83%	34%	40%	75%	50%
	Low quartile	20%	59%	16%	64%	33%
	High/low	4.17	0.58	2.57	1.17	1.50
GRE Analytical Writing	High quartile	100%	55%	43%	76%	14%
	Low quartile	63%	44%	22%	52%	0%
	High/low	1.60	1.23	1.96	1.45	N/A

Note. CIP = classification of instructional programs.

Table A40 GRE Quartile Comparisons: Doctorate Seekers

General program area (with its 2-digit CIP code)		Public administration & social service professions (44)	Social sciences (45)	Visual & performing arts (50)	Health professions & clinical sciences (51)	Business, management, marketing (52)	History (54)
k (Total # of universities contributing data)		5	5	3	8	4	3
N (Total # of students contributing data)		70	326	38	337	16	89
		Probability of grade of C+ or lower					
GRE Verbal Reasoning	Low quartile	22%	17%	11%	19%	25%	25%
	High quartile	0%	11%	0%	19%	33%	9%
	Low/high	N/A	1.50	N/A	1.03	0.75	2.72
GRE Quantitative Reasoning	Low quartile	19%	15%	0%	22%	0%	9%
	High quartile	13%	13%	11%	14%	33%	13%
	Low/high	1.51	1.16	0.00	1.53	0.00	0.72
GRE Analytical Writing	Low quartile	25%	19%	0%	20%	33%	5%
	High quartile	0%	11%	0%	13%	33%	6%
	Low/high	N/A	1.72	N/A	1.59	1.00	0.86
		Probability of cumulative graduate GPA $\geq$ 3.8					
GRE Verbal Reasoning	High quartile	80%	66%	100%	58%	67%	79%
	Low quartile	28%	42%	45%	41%	50%	43%
	High/low	2.88	1.59	2.22	1.41	1.33	1.83
GRE Quantitative Reasoning	High quartile	60%	45%	78%	63%	33%	73%
	Low quartile	46%	51%	79%	37%	25%	53%
	High/low	1.32	0.88	0.99	1.71	1.33	1.38
GRE Analytical Writing	High quartile	87%	64%	71%	47%	33%	69%
	Low quartile	32%	46%	65%	35%	33%	56%
	High/low	2.67	1.39	1.09	1.34	1.00	1.23

Note. CIP = classification of instructional programs.

Suggested citation:

Klieger, D. M., Cline, F. A., Holtzman, S. L., Minsky, J. L., & Lorenz, F. (2014). *New perspectives on the validity of the GRE® General Test for predicting graduate school grades* (GRE Board Research Report No. 14-03, ETS Research Report No. RR-14-26). Princeton, NJ: Educational Testing Service. doi:10.1002/ets2.12026

Action Editor: Brent Bridgeman

This report was reviewed by the GRE Technical Advisory Committee and the Research Committeeand Diversity, Equity and Inclusion Committee of the GRE Board.