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ABSTRACT

A limited number of studies have examined the relationship between admissions test scores, academic background, and college mathematics outcomes. This study investigated the predictive relationship between high school achievement, admissions test scores, selected demographic variables, and grade performance in college mathematics for 5,212 college students. Selected types of mathematics courses meeting general education requirements were examined individually and in aggregate to determine differential predictive validity with respect to course grades. The results of this study indicated that admissions test scores and high school class rank were significant predictors of subsequent achievement in college mathematics courses. In addition, the predictive validity of test scores and class rank combined improved as the courses' prerequisites and rigor increased. The relative importance of class rank increases and the importance of test scores decreases as the courses' prerequisites and rigor increase. Six tables and two figures present study findings. (Contains 12 references.) (Author/SLD)

Academic Background and Admissions Test Scores as Predictors of College Mathematics Outcomes

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ABSTRACT

A limited number of studies have examined the relationship between admissions test scores, academic background, and college mathematics outcomes. The purpose of this study was to investigate the predictive relationship between high school achievement, admissions test scores, selected demographic variables, and grade performance in college mathematics. Selected types of mathematics courses meeting general education requirements were examined individually and in aggregate to determine differential predictive validity with respect to course grades. The results of this study indicated that admissions test scores and high school class rank were significant predictors of subsequent achievement in college mathematics courses. In addition, the predictive validity of test scores and class rank combined improved as the courses' prerequisites and rigor increased. The relative importance of class rank increased and the importance of test scores decreased as the courses' prerequisites and rigor increased.

The effects of students' mathematics achievement can greatly impact their educational and career choices. Consequently, there is a great deal of interest in the identification of effective predictors of college mathematics achievement. Lower achievement levels in first-year college mathematics can restrict students' choices of majors and influence their subsequent career paths away from career options that require mathematical skills, such as business, science, and engineering. However, the effects of several factors that are related to low math achievement are not well understood (Oakes, 1990). There is evidence to suggest that students' motivation may be related to their prior achievement in math and their achievement is then predictive of continued enrollment in further advanced mathematics courses (Meece et al., 1982). However, there is a need for additional research to identify effective predictors of college mathematics achievement.

A limited number of studies have investigated the relationship between admissions test scores and subsequent achievement in specific college mathematics courses. In general, admissions test scores have been found to be significantly related to college mathematics performance. Considering the SAT, Troutman (1978) noted that SAT-Math scores were significant predictors of grades in Finite Mathematics. Similarly, Gussett (1974) found a significant relationship between students' SAT-Math scores and their subsequent grades in college freshmen mathematics. More recently, Bridgeman (1982) also found that SAT-Math scores were significant predictors of grades earned in elementary college algebra. Other research has investigated the predictive relationship between ACT scores and subsequent grades in college mathematics. Kohler (1973) noted that students' ACT-Math scores were significant predictors of their grades in college algebra. When college calculus grades were used as a criterion measure, Edge and Friedberg (1984) found that ACT-Math scores were significantly correlated with grades earned. House (1993a) found a significant correlation between ACT-Composite scores and grades earned in college Finite Mathematics. Finally, recent research has suggested that the combination of high school grades and ACT-Composite scores are particularly effective for predicting student achievement in several college mathematics courses (Noble & Sawyer, 1989).

The purpose of this study was to investigate the predictive relationship between high school achievement, admissions test scores, selected demographic variables, and subsequent performance in college mathematics. In addition to the limited number of studies which have examined the relationship between admissions test scores and college mathematics outcomes, even fewer studies have examined the relationship between admissions test scores, academic background, and subsequent achievement in several different general education mathematics courses. No studies to date have concurrently examined the predictive validity of SAT and ACT for mathematics outcomes. Selected mathematics courses were examined individually and in aggregate to determine differential predictive validity for each course. In short, the study sought to determine how well the independent variables predicted performance in mathematics courses, as well as how the predictive validity varied by course (e.g., do high school background and admissions test scores predict better for Calculus I than for Finite Mathematics?).

METHODS

Sample

The sample for this study was comprised of 5,212 students who enrolled in one of six university-level mathematics courses (described in detail below) meeting general education requirements during the period from fall 1987 to spring 1993. Only those students with a reported high school percentile rank and an ACT Mathematics or SAT Mathematics subscore (or both) were included in the sample. Of the students in the sample, approximately 92 percent provided ACT scores, 47 percent provided SAT scores, and 39 percent provided both ACT and SAT scores.

Measures

The following data were collected for each student: high school percentile rank in class, ACT Mathematics subscore, SAT Mathematics subscore, gender, ethnicity, and mode of entry (i.e., whether the student first enrolled as a new, first-time freshman or as a transfer from another institution). In addition, the grade earned (on a four-point scale) in each respective course was included as the criterion measure. The possible grades which a student could have earned were: A, B+, B, C+, C, D+, D, F, WF (withdrawal-failing), W (withdrawal), and AU (audit). The latter two grades were not included in calculations of mean grades.

The courses included in the study were 100-level courses typically taken for general education credit. Each of these courses meets, either fully or in part, the mathematics requirements for general education, though certain departments prescribe specific courses for their majors. The following is a list of the courses, their prerequisites, and descriptions:

Fundamentals of Statistics. Prerequisite: one and one-half years of high school algebra; one year of plane geometry. Description of sample data, probability, frequency distributions, testing hypotheses correlation, special topics.

Finite Mathematics. Prerequisites: one year of high school algebra; one year of plane geometry. Introduction to linear equations, linear programming probability, Markov processes, topics chosen from game theory, graph theory, combinatorics, computers. Applications of preceding material to games of strategy, management science, and optimization.

Liberal Arts Mathematics. Prerequisites: one year of high school algebra; one year of high school geometry. Topics designed to give students an appreciation for the beauty and extent of modern mathematics. Topics are chosen from number theory, topology, geometry, algebra, analysis, and probability.

Elements of Calculus I. Prerequisite: Three years of high school mathematics including one and one-half years of algebra and one year of geometry. Trigonometry is not required but recommended. Taken with Elements of Calculus II, this sequence constitutes a short course in calculus, taught at the intuitive level. It is intended primarily for students in biology, psychology, economics, or other fields which employ calculus as a tool.

Mathematical Analysis I. Prerequisites: one and one-half years of high school algebra; one year of plane geometry. Elements of algebra, equations and inequalities, functions and graphs, systems of equations, exponential and logarithmic functions. For students in the School of Business Administration.

Calculus I. Prerequisites: three years of high school mathematics, including one and one-half years of algebra and one-half year of trigonometry. Functions, limits, continuity, differentiation, analytic geometry, mean value theorem, theory of integration of continuous functions.

Analysis Procedures

Several procedures were used to analyze the data from this study. First, correlation coefficients were calculated to examine the relationships among the predictor variables as well as between the predictors and grades earned in the courses. Coefficients were computed separately for each course as well, and within each course by gender, ethnicity, and mode of entry.

Stepwise multiple regression was used to determine the relative contribution of each independent variable in predicting grades in the mathematics courses. A separate analysis was performed for each course, as well as one for all courses in aggregate. Using a stepwise procedure allowed for examination of the relative order of entry of each predictor, as well as its contribution to the overall model's ability to predict course outcomes.

Lastly, stepwise logistic regression was used to examine a dichotomous outcome for each course, namely, earning a satisfactory grade (C or better) vs. earning an unsatisfactory grade (D+ or lower). Logistic regression was used because of the binary nature of the outcome, while the stepwise method of entry was used once again to examine the order of predictor entry and the relative contribution of each predictor in explaining the outcome of the course.

One purpose of the paper was to examine differential prediction by course. It was hypothesized that courses of differing rigor and prerequisites would exhibit different patterns of predictive relationships. The courses were ranked in order from "most prerequisites/most rigorous" to "fewest prerequisites/least rigorous." The following reflects that ranking:

1. Calculus I
2. Elements of Calculus I
3. Fundamentals of Statistics
4. Mathematical Analysis I
5. Finite Mathematics
6. Liberal Arts Mathematics

Each of the tables describing the results of the aforementioned procedures is ordered in this "prerequisite/rigor" (P/R) ranking to allow for examination of any differences and trends found among and between different courses.

RESULTS

Descriptive statistics for grades earned and for each predictor variable are shown in Table 1. Means and sample sizes are presented by gender, ethnicity, and mode of entry for each course separately as well as for all six courses in aggregate. As hypothesized, grades earned, academic background, and admissions test scores differed by course, as well as by each of the demographic variables within each course. Generally, students' test scores and class rank increased as the P/R ranking of the course in which they enrolled increased. However, there was no clear relationship between P/R ranking and course grades (see Figure 1).

Women generally earned higher grades in these courses than did men, having entered with higher class ranks and lower test scores than men. Minority students entered with higher class ranks and lower test scores than did non-minority students, and earned lower grades in mathematics courses. Those students entering as freshmen earned higher math grades, and entered with higher test scores and class ranks than did those entering as transfers.

Correlations between predictor and criterion variables are shown in Table 2. Correlations were computed for the entire sample as well as separately for each course. In addition, correlations were calculated overall and within each course by gender, ethnicity, and mode of entry. Generally, most correlations were significant at the .01 level, due in part to large sample sizes. Math grades were slightly more correlated with high school class rank than with test scores for all courses combined, though the opposite was true for Fundamentals of Statistics and Finite Mathematics.

The only course-level correlation that showed any trend along the P/R scale was that between course grade and class rank, which increased as the course's prerequisites/rigor increased. Interestingly, the only course in which each course-level correlation was greater than for all courses combined was Fundamentals of Statistics, where, for example, the correlation between class rank and ACT-Math was .504 (vs. .392 overall).

Also of interest, the overall correlations between class rank and test scores were almost identical for ACT-Math and SAT-Math, though there was marked variation by course. The overall correlation between ACT-Math and SAT-Math was .764, ranging from .650 for Liberal Arts Mathematics to .782 for Fundamentals of Statistics. It is possible that the ACT and SAT Mathematics sections measured somewhat different attributes for these students, though these correlations represent only those who provided both ACT and SAT scores.

The results of the stepwise multiple regression analyses are shown in Tables 3 and 4. The models attempted to predict course grades using high school class rank, test scores (ACT-Math in Table 3, SAT-Math in Table 4), and dichotomous demographic variables (male/female, minority/non-minority, freshman/transfer). In Table 3, four of the five predictor variables (class rank, ACT-Math, ethnicity, and mode of entry) entered the regression equation significantly when all courses were combined. The overall regression equation explained 13.0 percent of the variance in math course grades, though most of it was explained by the first two variables entering the equation, class rank and ACT-Math.

The results of the regression analysis varied by course. For example, when examining Calculus I alone, the regression equation explained 27.4 percent of the variance in course grades, while the equation explained only 15.9 percent of the variance in Liberal Arts Mathematics grades. For all courses, class rank and ACT-Math entered either first or second, and together accounted for the majority of what variance in grades was explained by the model. Interestingly, the relative importance of class rank decreased and the importance of ACT-Math increased as the P/R ranking went down. That is, high school rank tended to enter the equation before ACT in the courses with greater prerequisites, while ACT entered before class rank as the prerequisites lessened. Further, class rank and ACT together tended to be better predictors of course grades at the higher P/R level than they were at the lower level (see Figure 2).

Table 4 (using SAT-Math rather than ACT-Math) shows results similar to those in Table 3, with SAT becoming more important in the regression equation as the course prerequisites and rigor lessened. Also, SAT and class rank predicted better for Calculus I (model r-square of .253) than for Liberal Arts Mathematics (r-square of .122). Overall, the model using SAT accounted for 15.3 percent of the variance in course grades, vs. 13.0 percent for the model using ACT. In the SAT model, the demographic variables contributed to grade explanation slightly better than in the ACT model.

Findings from the logistic regression analyses are found in Tables 5 and 6. The independent variables used in the previous regression analyses were used here as predictors of earning a satisfactory grade (A, B+, B, C+, C) vs. an unsatisfactory grade (D+, D, F, WF) in the course. The equation using ACT-Math is examined in Table 5, which shows that four of the five predictors (class rank, ethnicity, ACT-Math, and mode of entry) entered the equation significantly. Interestingly, ethnicity entered before ACT-Math in the overall equation, but not in the individual equations for each course. As in the multiple regression model, class rank decreased and ACT increased in importance as the course becomes less rigorous.

Table 6 shows the model using SAT-Math, which, like ACT-Math, entered third after class rank and ethnicity when the entire sample was considered. Generally, SAT-Math seemed not to predict satisfactory vs. unsatisfactory outcomes as well as did ACT-Math. The ACT score entered each equation significantly, whereas SAT-Math entered the models for neither Elements of Calculus I nor Liberal Arts Mathematics significantly.

DISCUSSION

The results of this study showed that high school percentile rank, ACT Mathematics subscore, and SAT Mathematics subscore were significant predictors of grades in mathematics courses that meet general education requirements. The predictive ability of these measures varied widely by course. Generally, grades in courses with more extensive prerequisites and covering more advanced material were better predicted by class rank and test scores than were grades in courses with fewer prerequisites and covering less rigorous material. Further, the importance of high school class rank diminished in favor of the importance of test scores as the courses examined became less rigorous and required fewer prerequisites.

When the outcome measure was a binary, satisfactory vs. unsatisfactory grade, similar patterns to the prior models were found, though ethnicity entered the overall equations before either ACT or SAT. In almost every case, including both the multiple and logistic regression equations, gender entered last or next to last and was not a significant predictor of mathematics outcomes (after accounting for test scores and class rank). Whether the student entered as a freshman or transfer also entered late into the equations, though was generally significant, with transfers showing better outcomes than freshmen *after accounting for other factors like scores and class rank*. However, transfers' mean class ranks (51st percentile vs. 73rd for freshmen) and mean test scores (19 vs. 23 ACT, 446 vs. 509 SAT) were significantly lower than those for freshmen, as were transfers' mean grades (e.g., 1.83 GPA in Calculus I for transfers vs. 2.61 for freshmen).

As a next step, the authors intend to undertake a multi-institutional investigation of the improvement in prediction of undergraduate mathematics performance by combining admissions test scores and high school class rank with *noncognitive measures*, such as student self-rating of mathematics ability or student expectancy of academic success. Previous research has indicated that noncognitive variables are significant predictors of several types of academic outcomes such as grade performance in specific courses (Gordon, 1989; House, 1993b) and of withdrawal from college (House, 1992). Recent research has indicated that, in some instances, noncognitive variables are more significant than admissions test scores as predictors of student achievement (House, 1993a). Consequently, research is needed to determine if combining noncognitive measures with test scores and class rank would result in improved prediction of student performance in a wide range of mathematics courses.

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Table 1

Descriptive Statistics by Course and Demographics

	Math Grade		H.S. &ile Rank		ACT-Math		SAT-Math	
	N	Mean	N	Mean	N	Mean	N	Mean
ALL COURSES	4,772	2.56	5,212	68.98	4,771	22.20	2,464	498.75
Men	1,933	2.51	2,1'5	65.41	1,914	22.94	1,017	518.76
Women	2,839	2.59	3,097	71.42	2,857	21.70	1,447	484.69
Minority	1,222	2.34	1,335	73.41	1,254	21.40	528	489.77
Non-Minority	3,550	2.64	3,877	67.46	3,517	22.48	1,936	501.20
Freshmen	3,837	2.59	4,172	73.39	3,866	22.94	2,081	508.52
Transfers	935	2.44	1,040	51.30	905	19.01	383	445.69
Calculus I	654	2.57	718	80.54	674	25.96	377	576.37
Men	315	2.50	351	77.03	324	26.25	176	590.91
Women	339	2.63	367	83.89	350	25.68	201	563.63
Minority	188	2.32	209	81.83	197	24.95	90	570.78
Non-Minority	466	2.67	509	80.00	477	26.37	287	578.12
Freshmen	619	2.61	669	81.74	629	26.20	359	580.33
Transfers	35	1.83	49	64.06	45	22.60	18	497.22
Elements of Calculus I	1,266	2.36	1,391	74.92	1,293	23.63	698	512.41
Men	540	2.33	597	71.49	548	24.00	289	530.17
Women	726	2.37	794	77.50	745	23.35	409	499.85
Minority	417	2.21	449	76.22	426	23.18	210	504.67
Non-Minority	849	2.43	942	74.30	867	23.84	488	515.74
Freshmen	1,142	2.37	1,253	76.21	1,175	23.89	637	516.36
Transfers	124	2.20	138	63.16	118	21.02	61	471.15
Fundamentals of Statistics	656	2.78	732	68.98	668	22.01	375	495.79
Men	213	2.71	236	64.46	211	22.55	117	515.73
Women	443	2.80	496	71.12	457	21.76	258	486.74
Minority	118	2.41	135	69.40	130	20.17	53	478.87
Non-Minority	538	2.86	597	68.88	538	22.45	322	498.57
Freshmen	474	2.82	525	75.11	489	22.83	289	508.30
Transfers	182	2.66	207	53.42	179	19.76	86	453.72

Table 1

Descriptive Statistics by Course and Demographics

	Math Grade		H.S. &ile Rank		ACT-Math		SAT-Math	
	N	Mean	N	Mean	N	Mean	N	Mean
Mathematical Analysis I	1,043	2.61	1,108	63.17	1,013	20.99	448	475.54
Men	514	2.57	547	58.53	499	21.54	241	489.34
Women	529	2.64	561	67.69	514	20.46	207	459.47
Minority	283	2.49	299	68.96	280	19.68	96	440.63
Non-Minority	760	2.66	809	61.02	733	21.49	352	485.06
Freshmen	849	2.68	892	67.46	820	21.68	389	478.77
Transfers	194	2.31	216	45.42	193	18.07	59	454.24
Finite Mathematics	289	2.35	343	62.32	309	19.36	140	452.64
Men	85	2.27	99	59.20	85	20.51	49	494.29
Women	204	2.38	244	63.59	224	18.92	91	430.22
Minority	65	2.11	79	69.01	73	17.64	24	407.92
Non-Minority	224	2.42	264	60.32	236	19.89	116	461.90
Freshmen	197	2.41	234	69.44	209	19.81	102	465.00
Transfers	92	2.20	109	47.05	100	18.42	38	419.47
Liberal Arts Mathematics	864	2.71	920	60.48	814	19.55	426	449.88
Men	266	2.72	285	54.53	247	20.25	145	468.07
Women	598	2.71	635	63.15	567	19.25	281	440.50
Minority	151	2.49	164	68.53	148	17.75	55	432.36
Non-Minority	713	2.76	756	58.74	666	19.95	371	452.48
Freshmen	556	2.76	599	67.02	544	20.36	305	460.33
Transfers	308	2.63	321	48.28	270	17.92	121	423.55

Table 2

Summary of Intercorrelations of Predictor Variables Overall and by Course and Demographics

	Grade/ HS Rank	Grade/ ACT-Math	Grade/ SAT-Math	HS Rank/ ACT-Math	HS Rank/ SAT-Math	ACT-Math/ SAT-Math
ALL COURSES	.289**	.269**	.274**	.392**	.393**	.764**
Men	.279**	.228**	.268**	.371**	.408**	.757**
Women	.293**	.308**	.295**	.447**	.441**	.765**
Minority	.283**	.233**	.265**	.274**	.322**	.784**
Non-Minority	.315**	.274**	.271**	.455**	.419**	.758**
Freshmen	.302**	.260**	.249**	.297**	.315**	.759**
Transfers	.276**	.282**	.415**	.318**	.454**	.732**
Calculus I	.435**	.415**	.354**	.304**	.297**	.750**
Men	.428**	.322**	.324**	.267**	.288**	.763**
Women	.443**	.505**	.400**	.389**	.391**	.741**
Minority	.330**	.452**	.442**	.255**	.386**	.811**
Non-Minority	.487**	.385**	.309**	.343**	.278**	.729**
Freshmen	.412**	.401**	.355**	.265**	.272**	.744**
Transfers	.510**	.422*	.122	.379**	.254	.730**
Elements of Calculus I	.355**	.313**	.253**	.281**	.262**	.688**
Men	.347**	.288**	.240**	.265**	.336**	.673**
Women	.364**	.340**	.288**	.333**	.274**	.699**
Minority	.352**	.297**	.291**	.142**	.158*	.648**
Non-Minority	.364**	.314**	.223**	.362**	.305**	.705**
Freshmen	.382**	.327**	.238**	.230**	.221**	.683**
Transfers	.161	.187*	.392**	.319**	.406**	.712**
Fundamentals of Statistics	.363**	.381**	.405**	.504**	.449**	.782**
Men	.361**	.303**	.360**	.485**	.474**	.769**
Women	.369**	.420**	.424**	.533**	.484**	.783**
Minority	.191*	.457**	.299*	.437**	.187	.815**
Non-Minority	.418**	.348**	.420**	.537**	.502**	.773**
Freshmen	.368**	.366**	.391**	.420**	.393**	.755**
Transfers	.407**	.447**	.511**	.470**	.414**	.848**

**$p < .01$, *$p < .05$

Table 2

Summary of Intercorrelations of Predictor Variables Overall and by Course and Demographics

	Grade/ HS Rank	Grade/ ACT-Math	Grade/ SAT-Math	HS Rank/ ACT-Math	HS Rank/ SAT-Math	ACT-Math/ SAT-Math
Mathematical Analysis I	**.317****	**.362****	**.288****	**.210****	**.154****	**.703****
Men	.296**	.317**	.317**	.199**	.163**	.730**
Women	.339**	.417**	.296**	.281**	.210**	.658**
Minority	.342**	.290**	.195*	.097	.034	.700**
Non-Minority	.329**	.388**	.307**	.312**	.206**	.694**
Freshmen	.311**	.325**	.242**	.099**	.081	.681**
Transfers	.213**	.361**	.578**	.080	.361**	.782**
Finite Mathematics	**.247****	**.372****	**.388****	**.242****	**.276****	**.720****
Men	.302**	.340**	.343*	.265**	.256*	.787**
Women	.231**	.389**	.445**	.270**	.314**	.642**
Minority	.163	.431**	.117	.023	.095	.617**
Non-Minority	.310**	.323**	.376**	.358**	.320**	.722**
Freshmen	.227**	.394**	.344**	.124*	.120	.690**
Transfers	.200	.274*	.449**	.231*	.410**	.789**
Liberal Arts Mathematics	**.302****	**.298****	**.292****	**.272****	**.353****	**.650****
Men	.329**	.274**	.362**	.240**	.385**	.618**
Women	.296**	.315**	.250**	.326**	.377**	.665**
Minority	.240**	.233**	.284*	.286**	.337**	.818**
Non-Minority	.340**	.303**	.289**	.315**	.373**	.626**
Freshmen	.254**	.268**	.207**	.131**	.186**	.667**
Transfers	.368**	.319**	.483**	.258**	.527**	.566**

**p < .01, *p < .05

Table 3

Summary of Stepwise Multiple Regression Analysis of Mathematics Grades Overall and by Course (using ACT Mathematics Subscore)

Step	Variable Entered	Model R-square	F	p
ALL COURSES				
1	High School Percentile Rank	0.080	255.59	0.0001
2	ACT Mathematics Subscore	0.110	159.39	0.0001
3	Ethnicity	0.124	71.86	0.0001
4	Mode of Entry	0.130	35.27	0.0001
5	Gender	0.130	2.32	0.1280
Calculus I				
1	High School Percentile Rank	0.188	91.77	0.0001
2	ACT Mathematics Subscore	0.265	58.52	0.0001
3	Ethnicity	0.273	7.20	0.0075
4	Mode of Entry	0.274	0.22	0.6420
5	Gender	0.274	0.05	0.8327
Elements of Calculus I				
1	High School Percentile Rank	0.119	105.85	0.0001
2	ACT Mathematics Subscore	0.168	71.52	0.0001
3	Ethnicity	0.173	6.84	0.0090
4	Mode of Entry	0.174	1.86	0.1727
5	Gender	0.174	0.02	0.8919
Fundamentals of Statistics				
1	ACT Mathematics Subscore	0.148	36.15	0.0001
2	High School Percentile Rank	0.186	51.73	0.0001
3	Mode of Entry	0.208	18.35	0.0001
4	Ethnicity	0.214	6.10	0.0138
5	Gender	0.215	0.14	0.7058
Mathematical Analysis I				
1	ACT Mathematics Subscore	0.131	107.34	0.0001
2	High School Percentile Rank	0.195	89.09	0.0001
3	Ethnicity	0.198	3.91	0.0482
4	Mode of Entry	0.200	3.12	0.0775
5	Gender	0.200	0.10	0.7560
Finite Mathematics				
1	ACT Mathematics Subscore	0.140	28.42	0.0001
2	High School Percentile Rank	0.160	8.48	0.0039
3	Ethnicity	0.180	4.34	0.0380
4	Gender	0.172	0.08	0.7826
5	Mode of Entry	0.172	0.05	0.8322
Liberal Arts Mathematics				
1	High School Percentile Rank	0.095	68.38	0.0001
2	ACT Mathematics Subscore	0.146	43.44	0.0001
3	Ethnicity	0.154	7.77	0.0054
4	Mode of Entry	0.159	5.73	0.0169
5	Gender	0.159	0.01	0.9369

Table 4

Summary of Stepwise Multiple Regression Analysis of Mathematics Grades Overall and by Course (using SAT Mathematics Subscore)

Step	Variable Entered	Model R-square	F	p
ALL COURSES				
1	High School Percentile Rank	0.099	178.62	0.0001
2	SAT Mathematics Subscore	0.125	72.53	0.0001
3	Ethnicity	0.145	57.30	0.0001
4	Mode of Entry	0.153	23.40	0.0001
5	Gender	0.153	1.60	0.2064
Calculus I				
1	High School Percentile Rank	0.205	62.33	0.0001
2	SAT Mathematics Subscore	0.253	20.58	0.0001
3	Ethnicity	0.256	1.31	0.2527
4	Gender	0.256	0.06	0.8019
5	Mode of Entry	0.256	0.03	0.8572
Elements of Calculus I				
1	High School Percentile Rank	0.141	79.09	0.0001
2	SAT Mathematics Subscore	0.167	17.32	0.0001
3	Ethnicity	0.183	12.48	0.0004
4	Mode of Entry	0.184	1.02	0.3131
5	Gender	0.184	0.03	0.8694
Fundamentals of Statistics				
1	SAT Mathematics Subscore	0.162	32.49	0.0001
2	High School Percentile Rank	0.216	42.47	0.0001
3	Mode of Entry	0.246	16.15	0.0001
4	Ethnicity	0.258	6.14	0.0136
5	Gender	0.258	0.29	0.5930
Mathematical Analysis I				
1	High School Percentile Rank	0.132	62.31	0.0001
2	SAT Mathematics Subscore	0.191	36.66	0.0001
3	Gender	0.198	4.69	0.0309
4	Mode of Entry	0.204	3.87	0.0498
5	Ethnicity	0.208	2.27	0.1328
Finite Mathematics				
1	SAT Mathematics Subscore	0.153	13.48	0.0003
2	High School Percentile Rank	0.203	7.95	0.0055
3	Ethnicity	0.233	5.17	0.0244
4	Gender	0.239	1.15	0.2855
5	Mode of Entry	0.240	0.16	0.6898
Liberal Arts Mathematics				
1	SAT Mathematics Subscore	0.091	21.29	0.0001
2	High School Percentile Rank	0.122	22.38	0.0001
3	Ethnicity	0.137	8.14	0.0045
4	Mode of Entry	0.140	1.68	0.1950
5	Gender	0.141	0.18	0.6713

Table 5

Summary of Stepwise Logistic Regression Analysis of Mathematics Success Overall and by Course (using ACT Mathematics Subscore)

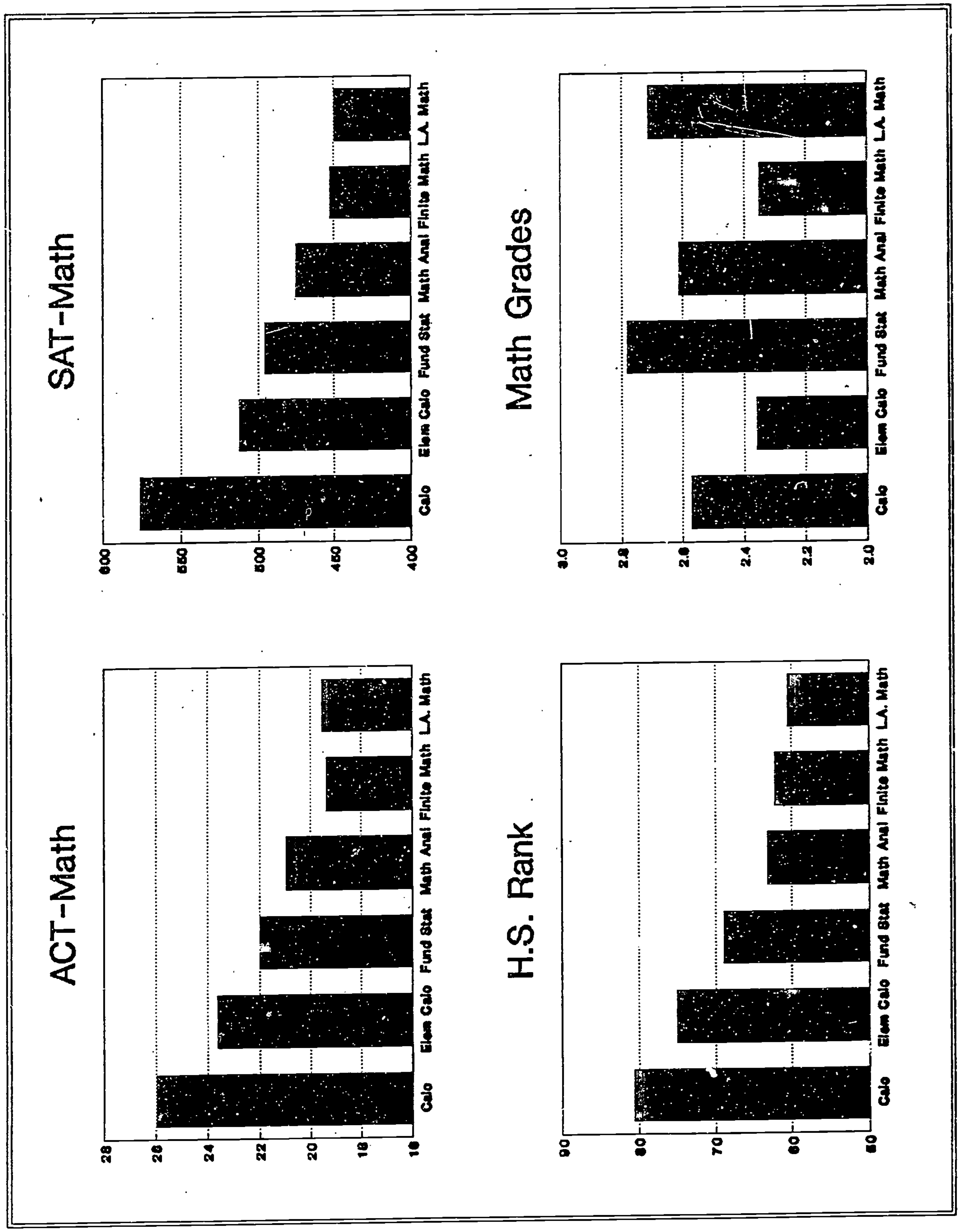
Step	Variable Entered	Wald Chi-square	p
ALL COURSES			
1	High School Percentile Rank	133.27	0.0001
2	Ethnicity	55.92	0.0001
3	ACT Mathematics Subscore	54.65	0.0001
4	Mode of Entry	21.66	0.0001
5	Gender	1.53	0.2157
Calculus I			
1	High School Percentile Rank	47.95	0.0001
2	ACT Mathematics Subscore	16.21	0.0001
3	Ethnicity	8.30	0.0040
4	Mode of Entry	0.49	0.4846
5	Gender	0.05	0.8282
Elements of Calculus I			
1	High School Percentile Rank	68.25	0.0001
2	ACT Mathematics Subscore	23.15	0.0001
3	Ethnicity	6.78	0.0092
4	Mode of Entry	3.36	0.0667
5	Gender	0.16	0.6901
Fundamentals of Statistics			
1	High School Percentile Rank	18.42	0.0001
2	ACT Mathematics Subscore	6.86	0.0088
3	Mode of Entry	5.54	0.0186
4	Ethnicity	1.77	0.1839
5	Gender	0.05	0.8277
Mathematical Analysis I			
1	ACT Mathematics Subscore	48.79	0.0001
2	High School Percentile Rank	44.11	0.0001
3	Mode of Entry	5.02	0.0251
4	Ethnicity	2.08	0.1494
5	Gender	0.36	0.5491
Finite Mathematics			
1	ACT Mathematics Subscore	13.66	0.0002
2	High School Percentile Rank	8.74	0.0031
3	Ethnicity	3.20	0.0735
4	Mode of Entry	1.09	0.2962
5	Gender	0.01	0.9625
Liberal Arts Mathematics			
1	ACT Mathematics Subscore	20.62	0.0001
2	High School Percentile Rank	16.66	0.0001
3	Ethnicity	10.82	0.0010
4	Mode of Entry	2.46	0.1169
5	Gender	0.12	0.7285

Table 6

Summary of Stepwise Logistic Regression Analysis of Mathematics Success Overall and by Course (using SAT Mathematics Subscore)

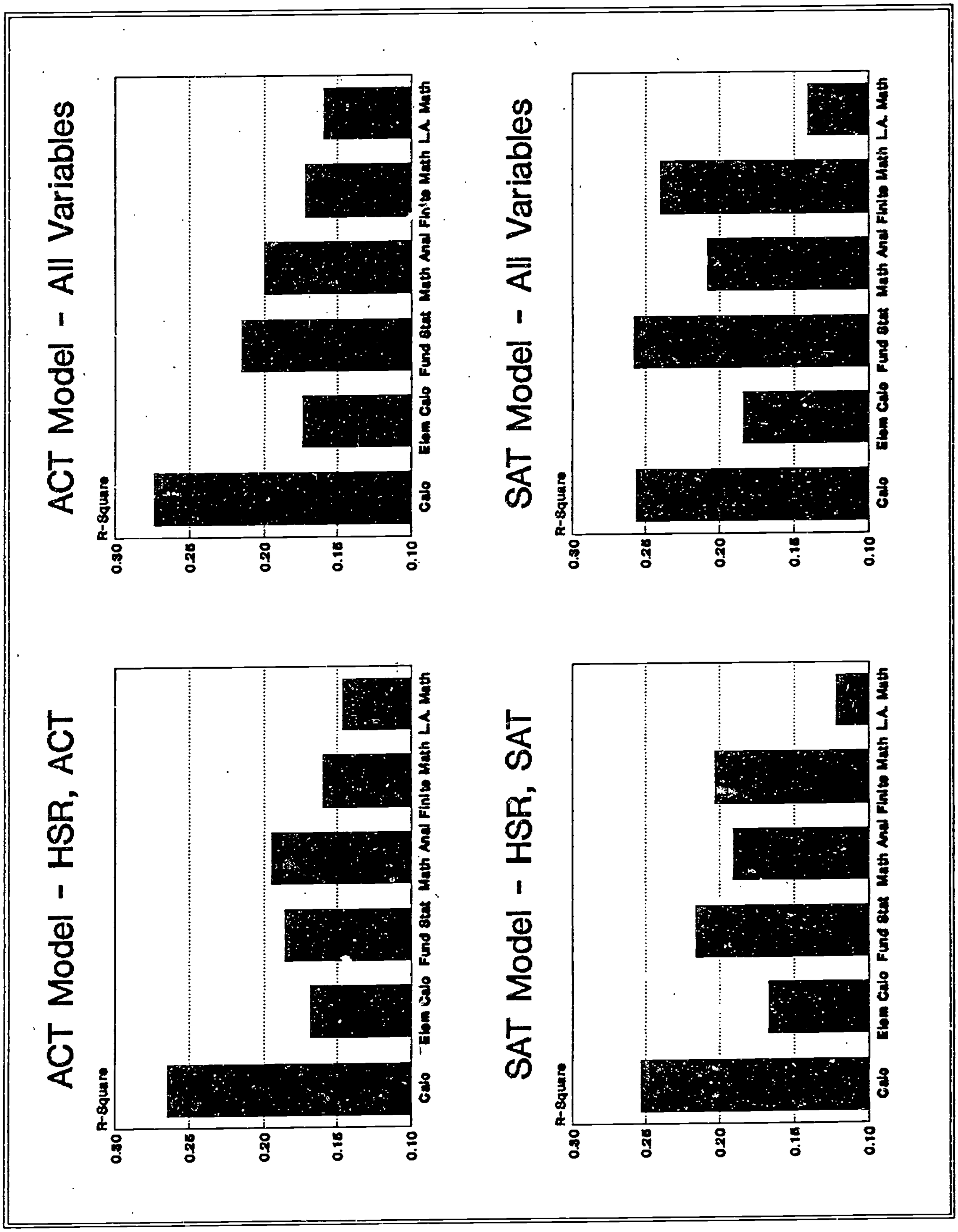
Step	Variable Entered	Wald Chi-square	p
ALL COURSES			
1	High School Percentile Rank	83.93	0.0001
2	Ethnicity	40.30	0.0001
3	SAT Mathematics Subscore	22.09	0.0001
4	Mode of Entry	13.07	0.0003
5	Gender	1.23	0.2682
Calculus I			
1	High School Percentile Rank	28.57	0.0001
2	SAT Mathematics Subscore	7.99	0.0047
3	Ethnicity	1.01	0.3143
4	Mode of Entry	0.40	0.5269
5	Gender	0.04	0.8361
Elements of Calculus I			
1	High School Percentile Rank	51.16	0.0001
2	Ethnicity	6.55	0.0105
3	SAT Mathematics Subscore	2.55	0.1103
4	Mode of Entry	2.50	0.1137
5	Gender	1.50	0.2212
Fundamentals of Statistics			
1	High School Percentile Rank	10.35	0.0013
2	SAT Mathematics Subscore	10.09	0.0015
3	Mode of Entry	2.95	0.0861
4	Ethnicity	2.03	0.1547
5	Gender	0.14	0.7053
Mathematical Analysis I			
1	High School Percentile Rank	22.80	0.0001
2	SAT Mathematics Subscore	19.71	0.0001
3	Gender	6.84	0.0089
4	Ethnicity	2.73	0.0984
5	Mode of Entry	2.57	0.1089
Finite Mathematics			
1	SAT Mathematics Subscore	12.84	0.0003
2	High School Percentile Rank	3.24	0.0719
3	Ethnicity	2.41	0.1208
4	Gender	2.07	0.1500
5	Mode of Entry	0.01	0.9267
Liberal Arts Mathematics			
1	High School Percentile Rank	8.04	0.0046
2	Ethnicity	7.96	0.0048
3	SAT Mathematics Subscore	3.71	0.0542
4	Mode of Entry	0.88	0.3482
5	Gender	0.01	0.9488

FIGURE 1



ACT-Math
28
26
24
22
20
18
16
Calc
Elem Calc
Fund Stat
Math Anal
Finite Math
L.A. Math
SAT-Math
600
550
500
450
400
Calc
Elem Calc
Fund Stat
Math Anal
Finite Math
L.A. Math
H.S. Rank
90
80
70
60
50
Calc
Elem Calc
Fund Stat
Math Anal
Finite Math
L.A. Math
Math Grades
3.0
2.8
2.6
2.4
2.2
2.0
Calc
Elem Calc
Fund Stat
Math Anal
Finite Math
L.A. Math

FIGURE 2


ACT Model - HSR, ACT
ACT Model - All Variables
SAT Model - HSR, SAT
SAT Model - All Variables
R-Square
0.30
0.25
0.20
0.15
0.10
Calc
Elem Calc
Fund Stat
Math Anal
Finite Math
L.A. Math