DOCUMENT RESUME

ED 334 916 HE 024 752

AUTHOR Hudson, J. Blaine
TITLE An Analysis of ACT Scores, Placement Tests, and Academic Performance in Reading, English, and Mathematics Courses.
INSTITUTION Louisville Univ., KY. Preparatory Div.
PUB DATE 21 Jul 89
NOTE 42p.
PUB TYPE Reports - Research/Technical (143)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS Academic Achievement; *Academic Advising; Basic Skills; College English; *College Entrance Examinations; College Freshmen; College Mathematics; Higher Education; *Performance Factors; Predictive Measurement; *Predictor Variables; Racial Differences; Reading Achievement; Scores; Sex Differences; *Student Placement; *Test Use
IDENTIFIERS University of Louisville KY

ABSTRACT

This study sought to examine American College Test (ACT) and basic skills placement test score patterns; the use of these test scores in academic advising; student performance in freshman level reading, English, and mathematics courses; relationships among these factors and their power to predict or account for placement and performance; and differences in the patterns of placement and performance by academic/enrollment unit, race, and sex. The study's population was all first-time students (N=1,854) admitted for Summer or Fall 1988 at the University of Louisville (Kentucky). The study found that advisors do use the ACT and other scores to place students in certain types and levels of courses, which serves to institutionalize the patterns of difference by race and sex that appear in test scores. However, the study also found that when students were allowed the opportunity to perform, their academic performance patterns did not conform to the test score and placement patterns noted. For example, female students earned consistently higher grades than male students, although female students had lower ACT scores and mathematics placement test scores. Race had no statistically significant bearing on performance except in mathematics. (JB)

AN ANALYSIS OF ACT SCORES, PLACEMENT TESTS, AND ACADEMIC PERFORMANCE IN READING, ENGLISH, AND MATHEMATICS COURSES

Preparatory Division
University of Louisville

July 21, 1989

Table of Contents

I. INTRODUCTION

Academic advising is one of the most significant determinants of the academic performance and persistence of college students. To be effective, the academic advising process must draw on and bring together various types of information related to the educational background, aspirations, and abilities of each student. School/college and institutional policies, practices, programs and limitations must also be considered and weighed in devising a course schedule designed, ideally, to meet the needs of each student.

Past performance in college courses is usually the best, although not an absolute, predictor of future performance. When this type of information is unavailable, as it is for first-time freshmen, academic advisors must rely heavily on data unrelated or only loosely related to the college experience, e.g., high school records, standardized test scores, the SAT or ACT, and diagnostic/placement test scores---if an institution has a placement testing program or requirement.

However skilled an institution's academic advisors, the effectiveness of freshman academic advising depends largely on the quality and accuracy of such information inputs and the assumptions which govern their use. Most institutions act on the assumption that this information can be used to answer two fundamental questions:

1) What is the level of academc preparation of each student, relative to the demands and expectations of a particular program and/or of the institution?

2) How does this level of preparation translate into a decision, among numerous possible options, as to the types of courses (e.g., preparatory, general education, honors) in which a student should begin his/her college career?

If this assumption is in error, or if these questions are answered incorrectly or incompletely, many students are likely to begin college in courses ill-suited to their needs, i.e., either too difficult or insufficiently challenging. Thus, two of the most critical decisions in each student's collegiate life are made, ususally without the direct participation of the student, <u>before</u> his/her first day in a college classroom.

Purpose of the Study

The purpose of this study is to examine ACT and basic skills placement test score patterns, how these test scores are used in academic advising, and how students perform in freshman level Reading, English and Mathematics courses. The relationships between these factors and their power to predict, or to account for, placement and performance will be explored.

The study will also analyze differences, if any, in the patterns of placement and performance by academic/enrollment unit, race and sex. Finally, an attempt will be made to assess the accuracy of what these instruments reveal, based on the available data, and the validity of the assumptions governing their use in academic advising.

II. DESIGN OF THE STUDY

Population

All first-time students admitted to the University of Louisville for Summer or Fall 1988, who took at least one of the basic skills placement tests, comprise the population under study.

Data Sources

The University of Louisville, as all public higher educational institutions in Kentucky, requires that entering students submit American College Test (ACT) scores prior to admission. Only students admitted to the Continuing Studies enrollment unit are exempted from this requirment.

While there is a state policy regarding the ACT, current University policies and practices regarding testing and the use of test results are far from uniform. Only the Preparatory Division requires that all first-time students complete the Reading, English and Mathematics placement tests prior to matriculation. However, the English and Mathematics Departments of the College of Arts and Sciences (A&S) have policies governing the placement of students (from any academic unit) in these course areas, based either on ACT sub-test scores or placement test results. The other freshman-admitting academic units adhere to the A&S policies.

Given this framework, Reading, English, Mathematics placement test results for this population were obtained from the University Testing Center. ACT and demographic information were secured from the Office of Admissions. The Office of the Registrar provided Course registration information and course grades in READ 098, READ 099, PREP 095, ENG 098, ENG 099, ENG 101, MATH 075, MATH 099, MATH 102, MATH 103. The College of Arts and Sciences granted permission for the release of grades in ENG 101 and MATH 102-108.

To limit the possibility of these data being "contaminated" by other academic and non-academic experiences, only placement, enrollment, and grades earned in first-time students' first semester/term were included in the study.

Research Methodology

The various data sources were combined to create a master CMS data base on the University computer system. Statistical analysis was performed using SPSSX.

Numerous tables appear throughout the report. For the most part, the tables reflect simple frequency distributions, percentages and means (averages). The more complex relationships between variables were examined using the Chi-Square statistic (to evaluate the discrepancy between actual and expected frequencies in a distribution), analysis of variance (to compare the variability within population groups to the variability between groups), correlation (to determine the linear---not causal---relationship between variables), and multiple regression (to determine whether the values of a given dependent variable can be predicted using one or more independent variables).

A relationship between variables, or sets of variables, was determined to be statistically significant if the probability of that relationship occuring by chance was less than one in twenty (the .05 level). Most of the relationships cited in this report had less than a one in one hundred (the .01 level) probability of occuring by chance.

III. Population Profile

Academic/Enrollment Unit Distribution

Of the more than 2,000 first-time students admitted to the University for Summer or Fall 1988, 1,854 were required or elected to take at least one basic skills diagnostic/placement test. The distribution of this population across academic/enrollment units (Table I) reflects the results of such testing requirements and options. As would be expected, both Preparatory Division and Arts and Sciences freshmen were somewhat over-represented.

Table I.

Population Distribution by Enrollment Unit
(column %)

	N	%
Preparatory Division	517	27.9%
Arts and Sciences	1,121	60.5%
Speed School	61	3.3%
Music School	18	1.0%
Allied Health	7	.4%
Continuing Studies	96	5.2%
Other	15	.8%
No Record	19	1.0%
Total	1,854	

Race and Sex Distribution

There were statistically significant differences (chi-square) in the distribution of students, by race and by sex (Tables II and III) across academic units. These differences seem to parallel those in the unit distribution, by race and sex, of all undergraduate students.

Table II.

Race by Enrollment Unit
(row %)

	White	%	Black	%	Other	%	Total
PD	326	67.5%	144	29.8%	13	2.7%	483
A&S	926	86.9%	99	9.3%	40	3.8%	1,065
Speed	45	77.6%	11	19.0%	2	3.4%	58
Music	13	76.5%	3	17.6%	1	5.9%	17
AH	4	100.0%	0	0.0%	0	0.0%	4
CS	49	79.0%	11	17.7%	2	3.2%	62
Other	11	84.6%	2	15.4%	0	0.0%	13
Total	1,374	80.7%	270	15.9%	58	3.4%	1,702

Table III.

Sex by Enrollment Unit
(row %)

	Male	%	Female	%	Total
PD	211	41.1%	302	58.9%	513
A&S	501	45.1%	611	54.9%	1,112
Speed	44	74.6%	15	25.4%	59
Music	8	44.4%	10	55.6%	18
AH	1	16.7%	5	83.3%	6
CS	35	38.9%	55	61.1%	90
Other	1	6.7%	14	93.3%	15
	801	44.2%	1,012	55.8%	1,813

White students were a significant majority in all academic units. The percentage of non-white students (19.3%) was higher than the percentage representation of non-whites in both the freshman and general undergraduate populations, indicating that non-white students---particularly black students (15.9%)---were roughly twice as likely to take one or more placement tests as were their white counterparts. Moreover, female students predominated, regardless of race, in virtually all units (with the exception of Speed School) and black females significantly outnumbered black males.

Enrollment

Of the 1,854 students tested, 285 (15.5%) chose not to enroll for Summer or Fall 1988 (Table IV). The pattern of non-enrollment differed significantly across academic units, with Music, Allied Health and Continuing Studies students being less likely to enroll after testing. However, there were no differences based on race, sex, ACT scores or course placement levels between those who did and did not enroll--- indicating that students' decisions regarding matriculation after testing were not influenced by placement test results.

Table IV.

Summer/Fall 1988 Enrollment by Enrollment Unit
(row %)

	Tested Enrolled	%	Tested Not Enrolled	%	Total
PD	439	84.9%	78	15.1%	517
A&S	975	87.0%	146	13.0%	1,121
Speed	50	82.0%	11	18.0%	61
Music	12	66.7%	6	33.3%	18
AH	4	57.1%	3	42.9%	7
CS	58	60.4%	38	39.6%	96
Other	12	80.0%	3	20.0%	15
	1,550	84.5%	285	15.5%	1,835

ACT and Placement Test Scores

Table V presents the distribution, by unit, of ACT scores, mean grade equivalent scores from the Nelson-Denny Reading test, and Mathematics placement test scores. There were statistically significant differences (based on analysis of variance) by academic unit, race and sex for all test scores.

Table V.

Mean ACT and Placement Test Scores

	PD	A&S	Speed	Music	AH	CS	Other	Group
ACT (N = 1,617)								
English	13.7	19.5	19.8	18.2	20.0	12.5	22.4	17.7
Math	9.8	16.7	21.1	12.9	15.8	7.7	17.9	14.7
Soc. Sci.	10.6	18.2	20.4	16.1	14.8	7.6	9.0	15.9
Nat. Sci.	15.5	21.7	25.1	19.5	19.0	14.6	23.4	19.9
Composite	12.5	19.2	21.8	16.8	17.8	10.7	21.3	17.2
Reading (N = 652)								
Vocab.	11.2	12.6	14.5	11.3		12.9		11.6
Comp.	10.8	12.3	14.3	9.2		10.4		11.1
Total	11.1	12.5	14.4	10.3		12.1		11.5
Mathematics (N = 1,259)								
Math 1	20.1	25.4	31.6	25.2	26.0	14.4	25.9	23.2
Math 2	9.3	13.0	17.1	10.8	8.5		13.0	13.0

The ACT distribution reflected both unit admission policies and the fact that few students in this population scored more than one standard deviation above (ca. 25) the University mean (ca. 20). Consequently, it is reasonable to conclude that the students in this sample represented most of the lower 80% to 85% of the ACT score distribution for all freshmen.

In general, female students had higher ACT English sub-test, Reading comprehension and total Reading scores. Male students had higher ACT Mathematics, ACT Natural Science, ACT Composite scores, Reading vocabulary, and Mathematics placement test scores. White students reported higher scores than did non-whites, with the exception of Asian and foreign students who had higher ACT Mathematics and Mathematics placement test scores.

The correlation matrix below (Table VI) illustrates the relationships between and among these test scores.

Table VI.

Correlation Matrix: ACT and Placement Tests

	ACT				Reading			Math
	Eng	M	SS	NS	Comp	Voc	Comp	Total	Placement
ACT E	----	.46	.59	.53	.78	.37	.39	.44	.42
ACT M			.43	.49	.74	.13	.11	.13	.62
ACT SS				.63	.84	.50	.38	.51	.32
ACT NS					.83	.37	.30	.38	.39
ACT Comp						.49	.42	.52	.56
Voc GE							.56	.91	-.02
Comp GE								.84	.06
Total GE									.01
Math Test									----

While most of the correlations were statistically significant, the correlation coefficients between the various tests were generally low. As might be expected, the correlations between sub-test scores and the composite or total scores of the same instrument were high. However, because comparatively low correlation coefficients can be significant in a large sample, it is useful to distinguish between "significance" and "importance." In this context, most of the correlations between different instruments, while statistically significant, did not reflect important relationships.

IV. COURSE PLACEMENT PATTERNS

The minimum standards for admission to the University require that students have either a cumulative 2.25 high school grade point average, a 12 or better ACT composite score, or evidence, based on diagnostic testing, that they can achieve college level competencies in one year. Students in the upper range for placement in ENG 098 and Math 075 meet this testing criterion, while only students placed in READ 099 or above are eligible for admission solely through the testing option. However, some students, who subsequently test below these "cut-offs", are nonetheless admissible on the strength of their high school grades or ACT scores alone. Consequently, students were still placed in READ 098, ENG 098, and MATH 075 despite more selective admission standards.

Reading Placement

Placement in Reading courses was based on the Nelson-Denny Reading test. The placement ranges were as follows:

Nelson-Denny Grade Equivalent	Reading Course Placement
below 7.0	READ 098 "Basic Reading Skills"
7.0 - 10.5	READ 099 "Reading Improvement"
10.6 - 12.9	PREP 095 "Learning and Study Skills
above 12.9	Exempt

Given these criteria, the Summer/Fall 1988 first-time student population was distributed across reading placement categories as depicted in Table VII.

Table VII.

Reading Course Placement by Unit
(row %)

	READ 098	READ 099	PREP 095	Exempt	Total
PD	19	169	214	103	505
%	3.8%	33.5%	42.4%	20.4%	
A&S	1	25	35	61	122
%	0.8%	20.5%	28.7%	50.0%	
Speed	0	0	1	6	7
%	0.0%	0.0%	14.3%	85.7%	
Music	1	1	1	2	5
%	20.0%	20.0%	20.0%	40.0%	
AH	0	0	0	0	0
%					
CS	4	16	11	34	65
%	6.2%	24.6%	16.9%	52.3%	
Other	0	0	0	0	0
%					
Total	25	211	262	206	704
%	3.6%	30.0%	37.2%	29.3%	

Since Reading is a requirement only in the Preparatory Division, Division students were a large and statistically significant (based on Chi-Square analysis) majority in all categories. However, all A&S entering freshmen in this population, who were required to take the English placement test (i.e., whose ACT English sub-test scores were below 16), were also tested in Reading on an experimental basis. Consequently, the number of A&S students tested was greater

than would have been the case ordinarily, and exactly 50% of the 122 A&S students in this experiment were determined to have a need for at least one Reading course. Moreover, male and non-white students, irrespective of their academic unit, were more likely to test into the lower level Reading courses.

English Placement

All Preparatory Division students were required to take the English placement test (an actual writing sample). However, as noted previously, students in the other academic units were tested only if their ACT English sub-test scores fell below 16. Consequently, placement in an English course was based on an actual evaluation of writing proficiency for all Division students, some Continuing Studies students, a minority (122, or 13.7%) of A&S students, and a few students in other academic units (Table VIII).

Table VIII.

English Course Placement by Unit
(row %)

	ENG 098	ENG 099	ENG 101	Total
PD	86	336	82	504
%	17.1%	66.7%	16.3%	
A&S	13	66	809	888
%	1.5%	7.4%	91.1%	
Speed	0	2	49	51
%	0.0%	3.9%	96.1%	
Music	2	2	8	12
%	16.7%	16.7%	66.7%	
AH	0	0	0	0
%				
CS	7	31	26	64
%	10.9%	48.4%	40.6%	
Other	0	0	11	11
%	0.0%	0.0%	100.0	
Total	108	437	985	1,530
%	7.1%	28.6%	64.4%	

As Table VIII indicates, most of the first-time students placed in ENG 098 and ENG 099 were Preparatory Division students. Of the A&S students tested, 79 (of 122, or 64.8%) were also placed in a pre-college level English course---as were 38 (of 64, or 59.4%) of the Continuing Studies students tested. Of the 809 A&S students placed in ENG 101, only 43 (or 5.3%) were placed on the basis of their performance on the English placement test.

As with the Reading courses, males and non-white students were more likely to be placed in the lower level English courses since their ACT English scores were lower and English placement, for most students, was based solely on ACT scores.

Mathematics Placement

All Preparatory Division students were required to take the Mathematics placement test. However, students enrolled in the other academic units were placed in mathematics either on the basis of ACT Mathematics sub-test scores---or, if they wished to challenge their placement level, based on their mathematics placement test results.

The Mathematics placement test has three sections, not all of which were attempted by every student. The course placement criteria, based on test performance or ACT Mathematics score, were as follows:

	Minimum Placement Test Score		ACT minimum
	Test I	Test II	
Group A (MATH 075)	----	----	----
Group B (MATH 099)	18		16
Group C (Math 102)	24	----	20
Group D (Math 103-190)	----	16	24
Group E (Math 205+)	----	22	28

Given these criteria, Table IX reflects course placement in Mathematics by academic unit.

Table IX.

Mathematics Placement Level by Unit
(row %)

	MATH 075	MATH 099	MATH 102	MATH 103-190	MATH 205	TOTAL
PD	176	174	143	0	2	495
%	35.6%	35.2%	28.9%	0.0%	0.4%	
A&S	83	185	694	100	38	1,100
%	7.5%	16.8%	63.1%	9.1%	3.5%	
Speed	0	1	10	3	42	56
%	0.0%	1.8%	17.9%	5.4%	75.0%	
Music	3	3	11	0	0	17
%	17.6%	17.6%	64.7%	0.0%	0.0%	
AH	2	2	3	0	0	7
%	28.6%	28.6%	42.9%	0.0%	0.0%	
CS	38	14	7	0	0	59
%	64.4%	23.7%	11.9%	0.0%	0.0%	
Other	1	3	10	0	1	15
%	6.7%	20.0%	66.7%	0.0%	6.7%	
Total	303	382	878	103	83	1,749
%	17.3%	21.8%	50.2%	5.9%	4.7%	

Of the 1,749 students placed in a Mathematics course, 1,732 (or 99.0%) took at least one section of the Mathematics placement test. Nearly two-thirds (64.4%) of the Preparatory Division students in this sample placed above MATH 075, the competency level required for transfer from the Division, but

less than 1% placed at or above the Math 103-190 level (i.e., the level of the new general education requirement). However, Division students represented only 51.1% (350 of 685) of all first-time students placed in a pre-college Mathematics course.

While there were statistically significant differences (based on Chi-Square analysis) in course placement distribution across academic units, most students (89.3%) placed at the MATH 102 level or below. Only Speed School students tended to place in the higher level courses more often than in the lower. There were also significant differences in placement patterns based on race, with Asian and foreign students most likely to place in MATH 102 or above, followed by white students, followed by black, Hispanic and Native American students.

Course Placement and Test Scores

The correlation matrix below (Table X) has been expanded to include course placement.

Table X.

Correlation Matrix: ACT, Placement Tests Scores, and Course Placement

	ACT Eng	ACT Math	ACT SS	ACT Comp	Placement RD.	Placement Math	Course Placement RD	Course Placement Eng	Course Placement Math
ACT E	----	.46	.59	.78	.44	.42	.29	.66	.37
ACT M			.43	.74	.13	.66	.01	.46	.52
ACT SS				.84	.51	.32	51	.51	.22
ACT Comp					.52	.56	.32	.64	.44
Read GE						.01	.86	.41	.01
Math Test							.04	.40	.83
Reading Course								.22	-.05
English Course									.34
Math Course									----

With regard to Reading and Mathematics, the correlations between the respective placement tests and actual course placement were much higher than the correlations between course placement and the ACT scores (English, Mathematics, Social Science and/or Composite) that would be used for placement in the absence of placement test scores. These differences indicate that most students were placed on the basis of the tests and that many students would have been placed differently (in higher or lower level courses) had these test results not been available.

Table XI summarizes three multiple regression procedures designed to determine, ultimately, how much of the variation in course placement can be "explained" using the available variables---and which variables have the greatest explanatory or predictive power.

Table XI.

Multiple Regression: Course Placement

	English	Reading	Math
Multiple R	.416	.884	.788
R-Square	.173	.781	.622
% of variance explained	17.3%	78.1%	62.2%
Major variables in the prediction equation	1. Total Reading score * 2. ACT English 3. ACT Math 4. Race 5. Sex	1. Total Reading score * 2. Sex 3. ACT Math 4. Race 5. ACT Nat. Sci.	1. Math Test II * 2. Race * 3. Sex 4. ACT English 5. ACT Nat. Sc

*: significant at or beyond the .05 level.

The multiple regression coefficients for Reading and Mathematics were quite high, accounting for 78.1% and 62.2% of the variation in course placement in these respective curricular areas. The most significant independent variables, moreover, reflected many of the same relationships between tests, race and sex discussed above. The lower correlation (Table X) and multiple regression coefficients for English would seem to result from the use of ACT English scores to place roughly two-thirds of the students placed in English and the English placement test to place the remaining third. This mix of placement methods, and the weak relationship between placement decisions based on the ACT and those based on the writing sample, made it more difficult to predict or to account for English placement.

Even without mixing placement methods, high coefficients (.80 or above) would be difficult to achieve since students within a range of test or ACT scores are all placed in one specific course, i.e., some "spread" in the data is unavoidable. For example, a student with a Reading score of 7.5 would be placed in the same course as a student with a score of 10.0, and a student with an ACT English score of 20 would be placed in the same course as a student with a score of 30.

To summarize, there were strong, direct and positive relationships between placement test results and actual placement patterns in Reading and Mathematics courses. For the most part, academic advisors were able to place students in these courses on the basis of information beyond that provided by the ACT. Conversely, placement patterns in English reflected greater variability as a result of the limited use of the English placement test and the more extensive use of the ACT.

V. Academic Performance Patterns

How students perform in actual college courses is a critical test of the efficacy of the assumptions which govern the admissions, testing and advising processes. In this phase of the analysis, only grades for English, Reading and Mathematics courses were included; semester grade point average, calculated on the basis of these and a multitude of possible combinations of others courses, was excluded.

Academic Performance in Reading

Table XII represents the distribution of Reading grades, by Reading course, of Summer and Fall 1988 first-time students.

Table XII.

Reading Grades by Reading Course
(column %)

	READ 098	READ 099	PREP 095	Total
A	5	38	45	88
%	38.5%	25.5%	26.5%	26.5%
B	5	52	66	123
%	38.5%	34.9%	38.8%	37.0%
C	2	39	37	78
%	15.4%	26.2%	21.8%	23.5%
F	1	14	14	29
%	7.7%	9.4%	8.2%	8.7%
W	0	6	8	14
%	0.0%	4.0%	4.7%	4.2%
I	0	0	0	0
%	0.0%	0.0%	0.0%	0.0%
Total	13	149	170	332

In general, most students tended to complete Reading courses successfully. The grade distribution was "high", in part, because no "D" grades were given in Division courses.

There were no significant differences in Reading grades across the various academic units, by Reading course, or by race---despite the significant differences between racial categories in Reading placement test score and course placement patterns. However, there were statistically significant (based on analysis of variance) differences between the grades of males and females, with females outperforming males. Thus, while both race and sex were closely related to test scores and placement, only sex was consistently related to academic performance in this area.

Academic Performance in English

In contrast to the distribution of Reading grades, there were significant differences in English grades by (Table XII) academic unit, English course and sex.

Table XIII.

English Grades by English Course
(column %)

	ENG 098	ENG 099	ENG 101	Total
A	13	81	73	167
%	15.9%	23.8%	7.7%	12.2%
B	36	126	322	484
%	43.9%	37.1%	34.0%	35.4%
C	25	55	398	478
%	30.5%	16.2%	42.0%	34.9%
D	0	0	58	58
%	0.0%	0.0%	6.1%	4.2%
F	5	63	63	131
%	6.1%	18.5%	6.7%	9.6%
W	3	13	33	49
%	3.7%	3.8%	3.5%	3.6%
I	0	2	0	2
%	0.0%	0.6%	0.0%	0.1%
Total	82	340	947	1,369

The 513 students (37.5% of all first-time students in English courses) who took the English placement test had higher English grades (2.49 compared to 2.31) than students who were placed solely on the basis of ACT English sub-test scores. This pattern held across academic units, and, even allowing for

the possibility of grade inflation in ENG 098 and ENG 099 (because no "D" grades were given), held in ENG 101 (2.43 compared to 2.28) as well. Consequently, it is reasonable to conclude that this difference in the basis of English placement accounted for some of the variation in performance in English. In other words, some students may not have performed as well because they were placed in ENG 101 on the basis of ACT English scores when placement testing would have revealed that they needed to begin in ENG 098 or ENG 099.

In contrast to Reading, the English grade distribution also differed significantly by course. For example, 90.3% of ENG 098 students earned "C's" or better, compared to 83.8% of ENG 101 students and 76.9% of ENG 099 students. Although elements of a curricular sequence, each of these courses may have presented students with a different set of problems and expectations.

Finally, female students tended to earn higher English grades than did male students. As with Reading, race was not a factor in the distribution of English grades, although race was related significantly to ACT English sub-test scores, writing placement test results, and course placement.

Mathematics

Acadmic performance in Mathematics (Table XIV) differed significantly by academic unit, Mathematics course, race and sex.

Table XIV.

Math Grades by Math Course
(column %)

	Mathematics						
	075	099	102	103	107	108	Total
A	44	52	86	2	7	8	199
%	19.7%	15.9%	15.5%	5.9%	14.0%	32.0%	16.4%
B	51	74	112	4	8	8	257
%	22.9%	22.6%	20.1%	11.8%	16.0%	32.0%	21.2%
C	48	100	139	11	17	5	320
%	21.5%	30.6%	25.0%	32.4%	34.0%	20.0%	26.3%
D	0	0	79	3	3	1	86
%	0.0%	0.0%	14.2%	8.8%	6.0%	4.0%	7.1%
F	66	85	101	9	10	1	272
%	29.6%	26.0%	18.2%	26.5%	20.0%	4.0%	22.4%
W	10	12	34	5	4	2	67
%	4.5%	3.7%	6.1%	14.7%	8.0%	8.0%	5.5%
I	4	4	5	0	1	0	14
%	1.8%	1.2%	0.9%	0.0%	2.0%	0.0%	1.2%
Total	223	327	556	34	50	25	1,215

In general, Preparatory Division and Speed School students earned grades lower, and Continuing Studies students earned grades higher, than the average for all students enrolled in Mathematics courses. Mathematics grade patterns, much as those in English, also differed significantly by course. However, unlike the students who took English courses, virtually all Mathematics students were placed in courses based on the Mathematics placement test. Consequently, the lack of widespread testing cannot in itself account for these patterns. It would seem far more likely that the source of some of this variation may be found either in the Mathematics curriculum or in how the placement test is used (e.g., the placement score ranges may be too high or too low).

In contrast to academic performance in both Reading and English, the significant relationship between race, ACT Mathematics sub-test scores and placement test results extended to grades. Asian and foreign students earned higher grades, followed by white students, followed by black students. However, while male students had significantly higher ACT scores and placement test results, female students earned higher grades in Mathematics.

Summary

Table XV summarizes many of the relationships and patterns discussed above.

Table XV.

Mean Reading, English and Math Grades by Unit and by Course

	PD	A&S	SS	Mus	AH	CS	Other	Group
Reading (N=334)	2.86	2.17	----	3.00	----	2.50	----	2.85
READ 098	3.00	----	----	3.00	----	----	----	
READ 099	2.83	1.75	----	----	----	2.50	----	
PREP 095	2.89	3.00	----	----	----	----	----	
English (N=1,368)	2.55	2.41	2.64	2.33	----	3.00	----	2.47
ENG 098	2.81	2.30	----	2.00	----	3.00	----	
ENG 099	2.54	3.02	3.50	----	----	2.62	----	
ENG 101	2.33	2.38	2.60	2.38	----	3.57	2.45	
Mathematics (N=1,214)	2.00	2.32	2.22	2.57	2.00	3.03	2.17	2.23
MATH 075	2.03	2.57	----	----	4.00	2.53	3.00	
MATH 099	1.99	2.28	----	3.00	----	3.23	2.00	
MATH 102	1.98	2.27	----	1.75	1.33	3.50	2.00	
MATH 103	----	2.10	----	----	----	----	1.67	
MATH 107	0.00	2.45	1.71	----	----	----	----	
MATH 108	2.50	3.05	3.00	----	----	----	4.00	

Furthermore, with this grade information, the correlation matrix may now be completed.

Table XVI.

Correlation Matrix: Tests, Placement, and Grades

	ACT				TESTS		PLACEMENT			GRADES		
	ENG	M	SS	COMP	RD	MATH	RD	ENG	MATH	RD	ENG	MATH
ACT E	----	.46	.59	.78	.44	.42	.29	.66	.42	.01	.05	.12
ACT M			.43	.74	.13	.66	.01	.46	.62	.08	.01	.17
ACT SS				.84	.51	.32	.27	.51	.32	-.01	.04	.07
ACT COMP					.52	.56	.32	.64	.56	.04	.02	.14
READ GE						.01	.86	.41	.01	.02	.11	.06
MATH TEST							-.02	.40	.83	.14	.07	.01
READING PLACEMENT								.22	.04	.01	.06	.08
ENGLISH PLACEMENT									.40	.07	-.10	.18
MATH PLACEMENT										.14	.07	.01
READING GRADES											.49	.45
ENGLISH GRADES												.36
MATH GRADES												----

As this matrix indicates, tests tended to be highly and positively correlated with other, similar tests, and academic performance in one course area tended to be correlated with academic performance in the other course areas. However, neither ACT scores nor placement test results correlated to any appreciable extent with academic performance. This finding is consistent with the data presented in the ACT Standard Research Service Reports of the past decade.

VI. Predicting Academic Performance

Beyond identifying differences in placement and performance, some attempt must be made to account for these differences and to determine if it is possible to use the available variables for predictive purposes. Tables XVII, XVIII and XIX reflect the most pertinent sections of multiple regression analyses generated for each Reading, English and Mathematics course. Read 098, Math 103, 107, and 108 have been excluded due to their limited enrollment.

Table XVII.

Multiple Regression: Reading Grades by Reading Course

	READ 099	PREP 095	Aggregate
Multiple R	.295	.375	.230
R-Square	.087	.141	.053
% of variance explained	8.7%	14.1%	5.3%
Major variables in the prediction equation	1. ACT Eng	1. ACT Eng	1. Math Test *
	2. Race	2. Sex *	2. Sex *
	3. ACT Math	3. Race *	3. Race
	4. ACT NS	4. ACT SS	4. ACT SS
	5. Sex	5. Math Test	5. Eng. Test

*: significant at or beyond the .05 level.

Table XVIII.

Multiple Regression: English Grades by English Course

	ENG 098	ENG 099	ENG 101	Aggregate
Multiple R	.318	.293	.448	.311
R-Square	.101	.086	.201	.096
% of variance explained	10.1%	8.6%	20.1%	9.6%
Major variables in the prediction equation	1. Math Test	1. Math Test*	1. ACT SS	1. Math T.
	2. ACT SS	2. ACT SS	2. Race *	2. Eng. Course
	3. Read GE	3. Sex *	3. Math Test	3. ACT SS
	4. Race	4. Race	4. Sex	4. Sex
	5. ACT Eng.	5. ACT Eng.	5. ACT Eng.	5. Race

*: significant at or beyond the .05 level.

Table XIX.

Multiple Regression: Math Grades by Math Course

	MATH 075	MATH 099	MATH 102	Aggregate
Multiple R	.399	.319	.365	.274
R-Square	.159	.102	.133	.075
% of variance explained	15.9%	10.2%	13.3%	7.5%
Major variables in the prediction equation	1. ACT Comp 2. Eng. Course * 3. Math Test 4. Sex 5. Race	1. ACT Math * 2. Reading Course 3. Math Test 4. Sex * 5. Race	1. ACT Eng 2. ACT Math 3. ACT NS 4. Race 5. Eng. Course	1. Eng. Course * 2. ACT Math * 3. Math Course * 4. Race 5. ACT SS

*: significant at or beyond the .05 level.

With the exception of ENG 101, the available variables produced multiple regression coefficients no higher than .40, with several below .30. Ironically, the variables associated most closely with course placement were seldom among the variables with significant power to predict, or account for, academic performance. Moreover, the regression equations differed between courses in the same skill area and between skill areas. In essence, the factors which predicted course placement with acceptable accuracy did not predict performance.

With respect to interpretation, these analyses raise as many questions than they answer. For example, if ACT English

or Mathematics sub-test scores were predictors of actual performance in English and Mathematics courses, these variables should have correlated highly with course grades and should have contributed to regression equations which explained an acceptable percentage of the variation in course grades. Similarly, if the placement tests were predictors of performance, their power to predict should have been evident in the analysis of variance, correlation and regression procedures. However, neither ACT nor placement tests seemed to have more than a coincidental relation to performance---even when grades were analyzed by course.

The results of these analyses by course were particularly interesting since this approach restricted the range of ACT and placement test scores. This reduced, if it did not eliminate, the confounding effect of students with "low" ACT or test scores (in the lower level courses) earning "high" grades and students with "high" ACT or test scores (in the higher level courses) earning low grades. Thus, with this control, for example, students with ACT or placement test scores in the "upper end" of the range for a given course should have had a higher probability of earning "high" grades. However, if the criterion (or criteria) on which placement in a given course was based did not account for differences in performance in that course, then either that criterion was meaningless for predictive purposes---or its influence was negligible in the absence of factors with greater predictive power.

With regression coefficients so low, and with so little of the variance in grades "explained", it is obvious that factors other than those most commonly used must be introduced and weighted if even half of the variance in grades is to be explained (which would require Multiple R's in the +.70 range). These "other" factors may be academic (e.g., better tests), institutional (e.g., curricular changes), support (e.g., utilization of tutoring) or simply non-academic (e.g., student-motivation, student and teacher attitudes, student/institutional "fit").

In seeking to interpret and understand this phenomenon, it is also important to note that this population must be viewed, much as any large group of college students, not as one homogeneous population, but rather as an aggregation of heterogeneous sub-groups defined on the basis of common demographic and/or academic characteristics. The University ---and its policies, programs, and multiple institutional environments---may have impacted these sub-groups differently. The following grade probability information (Tables XX, XXI and XXII) is an illuminating test of this hypothesis.

Table XX.

Probability of Earning a Grade of "C" or Better in a Reading Course (N of chances out of 10)

	READ 098	READ 099	PREP 095
Male			
Black (N=41)	10.0	8.0	8.3
White (N=73)	10.0	8.8	9.0
Other (N=5)	10.0	10.0	10.0
Female			
Black (N=64)	8.0	10.0	9.2
White (N=127)	10.0	8.8	9.5
Other (N=5)	----	10.0	----
Unit			
PD	9.2	9.1	9.1
A&S	----	7.5	10.0
CS	----	10.0	----

Table XXI.

Probability of Earning a Grade of "C" or Better in English (N of chances out of 10)

	ENG 098	ENG 099	ENG 101
Male			
Black (N=74)	10.0	7.3	6.4
White (N=477)	8.9	7.4	8.9
Other (N=18)	10.0	8.9	10.0
Female			
Black (N=134)	9.4	8.4	9.1
White (N=571)	10.0	8.5	9.5
Other (N=22)	10.0	10.0	9.4
Unit			
PD (N=393)	9.4	8.0	8.8
A&S (N=830)	9.0	8.9	8.6
SS (N=49)	----	10.0	9.3
Mus (N=9)	10.0	----	10.0
AH (N=0)	----	----	----
CS (N=26)	10.0	7.5	10.0
Other (N=10)	----	----	7.0

Table XXII.

Probability of Earning a Grade of "C" or Better in Mathematics (N of chances out of 10)

	MATH 075	MATH 099	MATH 102	MATH 103	MATH 107	MATH 108
Male						
Black (N=58)	5.5	5.0	3.1	----	----	----
White (N=378)	7.8	7.0	5.5	3.3	6.8	8.6
Other (N=19)	10.0	6.7	8.9	10.0	10.0	10.0
Female						
Black (N=112)	4.6	6.9	7.3	5.0	3.3	10.0
White (N=510)	7.3	7.3	7.1	7.1	7.5	8.6
Other (N=19)	3.3	10.0	8.8	5.0	10.0	10.0
Unit						
PD (N=364)	6.6	6.5	5.3	----	0.0	10.0
A&S (N=706)	7.4	7.7	6.8	6.3	7.3	8.9
SS (N=8)	----	----	----	----	7.1	10.0
Mus (N=6)	----	10.0	7.5	----	----	----
AH (N=4)	10.0	----	3.3	----	----	----
CS (N=34)	7.5	9.2	10.0	----	----	----
Other (N=11)	10.0	10.0	6.7	0.0	----	10.0

The different ways in which these sub-groups were impacted were often obscured by and submerged in averages and aggregate data. However, as these Tables reveal, programs which served some students effectively were of less benefit to others.

It is equally important to understand that, once students register for a particular course, any number of other factors may come into play. Student performance can be impacted by personal and financial problems, work, teacher attitudes, study habits, motivation, institutional environment and many other variables. In addition, the use of support services such as tutoring can represent an intervening variable that can boost the performance of "higher risk" students and, therefore, muddy statistical analysis as well.

VII. Conclusion and Recommendations

Course placement policies and the actions of academic advisors as they relate to first-time freshmen assume that certain numbers---ACT scores and placement test scores, specifically---indicate whether or not students are prepared for certain types and levels of courses. This research has confirmed how extensively these "numbers" are used and that the differences by race and sex most often associated with these "numbers" in the research literature are reflected in course placement patterns.

Whatever their source, and whether or not they are meaningful, the differences students bring to the University as a result of their past educational experiences are institutionalized, albeit unintentionally, through the University's admissions and advising policies. However, as this study indicates, these initial differences are not absolute determinants of the academic "fate" of any student and, when students are allowed an opportunity to perform, their academic performance patterns do not conform to the test score and placement patterns noted above.

For example, female students earned consistently higher grades than did male students, although female students had lower ACT scores (except for the English sub-test) and Mathematics placement test scores. Race was a decisive factor in ACT, placement test and course placement patterns, but had no statistically significant bearing on performance---except in Mathematics. Moreover, of all race/sex sub-groups, black males were the highest risk population, or, stated differently, the population with the greatest need, regardless of their ACT and placement test results.

While this analysis did not yield reliable grade predictions for students in the aggregate, it does illuminate how, and how differently, the various sub-groups perform once students have been placed in courses where all students have similar academic profiles. This information may be of great value to advisors as an indicator of which students are most likely to need extra assistance, more frequent monitoring and follow-up.

This study also suggests that more placement testing, rather than less---and, perhaps, a review of the placement tests, placement ranges and criteria---is needed. Whatever the weaknesses of the tests, they seem to provide more reliable and useful information than the ACT. It is highly probable that most first-time freshmen would be placed more accurately if

Mathematics, English and Reading placement test scores were available to academic advisors. Testing all first-time students with ACT scores below the state or national mean (20), or below one standard deviation above the mean (25), in each of these skill areas could be a major improvement. Moreover, despite the autonomy of the various academic units, more uniformity in testing, placement and advising policies ---particularly for the first-year population---could be a decided benefit to students.

There are several potentially fruitful directions for future research:

1) A study to determine whether the variation in grade distribution is greater between different sections of the same course than within specific sections---or between courses. In essence, this research would use the "course instructor" as a variable.

2) A follow-up study to determine the extent to which the lower level courses actually prepare students for the higher level courses in each skill area. This research could also focus on articulation between courses in a curricular sequence.

3) A study to determine the relationship between placement and performance in the skills courses---and overall academic performance and retention. This research could also determine whether ACT and placement test scores are better long-term, than they are shorts-term, predictors of performance.

4) A study to test and identify, if possible, the academic and non-academic variables which produce more accurate predictions of performance.

5) A study to test the usefulness of the Enhanced ACT assessment.

Academic performance in the first semester of students' first year in college is one of most reliable predictors of persistence and eventual graduation. Consequently, this study has focused on the identification, analysis and interpretation of the placement and performance patterns of a large number of students in this restricted timeframe. Within these limitations, the results should be of value as a point of departure for future research and as a resource for planning and program/policy review.

J. Blaine Hudson, Ed.D. (07/21/89)