Minority Graduate Education

RESEARCH AGENDA FOR THE GRADUATE RECORD EXAMINATIONS BOARD MINORITY GRADUATE EDUCATION PROJECT: *An Update*

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INTRODUCTION

In 1982, the Minority Graduate Education Committee (MGEC) of the Graduate Record Examinations Board called for the development of a research agenda that would address the severe underrepresentation of minority students in graduate education. The MGEC, in its Programmatic Plan for Research Related to Minority Access to Graduate Education, identified four critical stages in the graduate education process that the research agenda should address: preadmission, admission, enrollment, and retention/completion. In addition, the MGEC identified several priorities for further study. These included:

- The demographic profile of the pool of potential graduate students
- The characteristics of institutional graduate admission processes
- The impact of test scores and other traditional performance indices on the admission process and their relationship to predicting graduate outcomes
- The effect of geographic location and financial aid on decisions to enroll in graduate education
- The role of institutional practices (support systems and the graduate education environment) on progression through graduate school and on degree attainment

The MGEC also specified that the research agenda should reflect minority perspectives on the graduate experience and should be governed by attention to two critical concerns:

- The collection of information needed to guide policy decisions for increasing minority graduate participation by and within specific minority groups
- The role of cultural differences in minority participation (Williams, 1984)

The MGEC's request resulted in the development and publication of the Research Agenda for Graduate Record Examinations Board Minority Graduate Education Project (Baratz-Snowden, Brown, Clewell, Nettles, & Wightman, 1987). This paper reviewed the literature in areas identified by the GRE Board/MGEC plan and, within those areas, identified gaps in present knowledge. The authors placed the focus of the agenda--undergraduate experiences through graduate degree completion--within the broader context of the education pipeline. They presented the demographic data concerning that pipeline and examined issues related to preadmission decisions, admission, retention, and completion of graduate study. The paper concluded by identifying areas for further research and discussing some difficulties associated with conducting research at the graduate level.

The Research Agenda proposed six studies to address information gaps identified in the literature review. They were:

1. A survey of college seniors to determine their postbaccalaureate plans and to address questions of career choice, options competing with graduate study, debt burden and its role in decision making, and, for students applying directly to graduate school, application strategies and knowledge about the admission process.

2. A secondary analysis of the Recent College Graduates Survey to learn more about options competing with decisions to participate in graduate education and the role of historically Black colleges in the production of graduate school candidates.

3. A survey of deans and staff at a sample of the approximately 350 institutions granting doctoral degrees in the United States to determine the admission practices for minority candidates.

4. A survey of a sample of minority students from the approximately 50 institutions that produce well over 50 percent of the minority doctoral degree recipients to learn more about factors contributing to student decisions to enroll and persist within these institutions.

5. A survey designed to address questions about the amounts and types of financial assistance available to minority graduate students and the effects of different types of financial aid on minority student experiences and progress in graduate programs.

6. Case studies of institutions with exemplary programs that have resulted in increased minority student enrollment and degree completion to gain an understanding of what works, *how* it works, and under what conditions.

Three previously funded Minority Graduate Education projects were also included in the Research Agenda:

7. A survey of 1,600 doctoral students on four campuses to determine how factors such as race, gender, academic discipline, and financial aid affect progression and persistence in graduate school (Nettles, 1990)

8. A secondary analysis of the National Research Council's Survey of Doctorate Recipients to address questions such as: What proportion of the minority doctoral pool enters academic careers? What are those career patterns like? Do they vary by racial/ethnic group, field of study, or gender? (Brown, 1988)

9. A study examining milestones in graduate careers (advancement to candidacy, completion, various measures of academic potential) and their relationship with undergraduate grade point average and GRE test scores (Zwick, 1991)

The GRE Board subsequently funded studies by Wilder and Baydar (1990) and Thomas, Clewell, and Pearson (1992), a study of profiles and persistence of underrepresented minority doctorate recipients (Brown, in progress), and a

study of underrepresented minority women in science and engineering graduate education (Brown, in progress).

To date, the Minority Graduate Education research project has produced seven reports on its research (Baratz-Snowden et al; 1987; Brown, 1987; Brown, 1988; Nettles, 1987; Nettles, 1990; Thomas, Clewell, & Pearson, 1992; Zwick, 1991). In addition, the GRE Board has funded three studies under other research frameworks that address issues in minority graduate education (Clewell, 1987; Ekstrom, Goertz, Pollack, & Rock, 1991; and Pennock-Roman, 1990). Results from several of these studies were presented at the conference, "Minorities in Graduate Education: Pipeline, Policy and Practice," sponsored by ETS and the GRE Board in May 1990. The conference proceedings, which also included suggestions for future research, were published recently (Jones, Goertz, & Kuh, 1992).

This research agenda update uses the studies supported by the GRE Board, the presentations made at the "Minorities in Graduate Education: Pipeline, Policy, and Practice" conference, and other recent research to update the original Research Agenda. This update includes demographic trends and the factors contributing to the underrepresentation of minorities in graduate education. It covers preadmissions issues, admission and enrollment issues, the impact of test scores on the admission process, and graduate school retention and completion. The focus is on the period between 1982, when the MGEC recommended the development of a research agenda, and 1990, when the "Minorities in Graduate Education" conference was held. This update also identifies critical areas for future policy, practice, and research, with an emphasis on topics not covered in the 1987 Research Agenda document.

This paper is divided into three sections. The first presents a demographic perspective and includes data on the numbers of minority students completing high school, college, and graduate education. The second section describes research findings that help to explain the demographic data, with an emphasis on studies funded by the MGEC and GRE Board. The final section provides suggestions for future research.

I. DEMOGRAPHIC PERSPECTIVE

This section describes minority student enrollment and degree attainment patterns in the upper portion of the education pipeline -- high school graduation, college enrollment and graduation, and graduate or professional school enrollment and completion. The primary focus is on Black and Hispanic students, but data on American Indian and Asian American students are presented where available. The section is based, in part, on reports prepared by Brown (1987, 1992). Additional information comes from the American Council on Education's reports on minorities in higher education. Vining Brown's reports involved a review of the literature and analyses of the Higher Education General Information Survey (HEGIS) and data about GRE test takers.

High School Graduation Rates

During the past decade, there has been notable growth in the number of minority students completing high school. Table 1 shows the number of Black, Hispanic, and White youths in the age 18-24 cohort in 1980 and 1990 who had graduated from high school. It also shows the high school completion rate for each group. The data in this section, as well as in the table, come from Carter and Wilson (1992) and are derived primarily from U.S. Census reports.

The Census data cited by Carter and Wilson show that the number of Black individuals in the age 18-24 cohort declined from 3,721,000 in 1980 to 3,520,000 in 1990. The number of White individuals in this age cohort also declined from 24,482,000 in 1980 to 20,393,000 in 1990. There was an increase in the number of Hispanics in this age cohort, from 2,033,000 in 1980 to 2,749,000 in 1990.

The number of Black and Hispanic high school graduates in the 18 to 24 age cohort grew during the decade, while the number of White high school graduates declined. The high school completion rate for Black youth rose during this period, while the rates for Hispanic and White youth showed little change. Despite the increase in the high school completion rate in the Black population, it is still somewhat below the rate for Whites. Both Black and White students had a considerably higher high school completion rate than Hispanic students.

Directly comparable data on high school completion rates for American Indian and Asian American students are not available from the Census Current Population Reports (CPR). (The 1990 Census included a one-time collection of these rates, but this information is not yet available.) Estimates, based on data from High School and Beyond (HS&B), for high school completion rates of American Indians are approximately 67 percent and approximately 93 percent for Asian Americans. It should be noted, however, that there is considerable variation in rates across Indian reservations and across Asian subpopulations. For example, high school completion rates are low among Lumbee and Navajo tribe members but higher among Creek and Choctaw individuals (O'Brian, 1992a).

The number of Black males graduating from high school increased between 1980 and 1990, but there was a slight decline in the number of Black women

Table 1

Number of Black, Hispanic, and White High School Graduates in the Age 18-24 Cohort; and High School Completion Rates, 1980 and 1990; and Change in Number and Completion Rate

(Sum of male and female graduates may not equal total because of rounding.)

	H.S. Graduates (Thousands)			Completion Rate (Percentage)		
	1980	1990	Change Thousands	1980	1990	Change %
BLACK - Total	2,592	2,710	+118	69.7	77.0	+7.3
Females	1,475	1,468	-7	72.6	77.8	+5.2
Males	1,115	1,240	+125	66.0	75.9	+9.9
HISPANIC* - Total	1,099	1,498	+399	54.1	54.5	+0.4
Females	579	745	+166	56.7	55.3	-1.4
Males	518	753	+235	51.2	53.7	+2.5
WHITE - Total	20,214	16,823	-3,391	82.6	82.5	-0.4
Females	10,528	8,666	-1,862	84.4	83.8	-0.6
Males	9,686	8,157	-1,529	80.6	81.1	+0.5

* Hispanics can be of any race.

Source: Carter and Wilson, *Minorities in Higher Education*, ACE, 1992

graduates. The high school completion rate rose more among Black males than among Black females. Although the number of Hispanic high school graduates increased, the completion rate for females decreased slightly, and the completion rate for males increased slightly. These changes narrowed the gender gap that produced concern in 1980.

It has been predicted that "between 1986 and 1995 the total pool of minority high school graduates will increase, but only Hispanics and Asian Americans are expected to achieve sustained annual growth during the period. By 1995 the number of Asian and Latino high school graduates will increase 58 and 52 percent, respectively, while the number of African American graduates will decline by 2.6 percent" (Carter & Wilson, 1992, p. 1).

The projected increase in minority high school graduates means that, during the 1990s, more minority students will probably participate in higher education. As the number of White students of traditional college age declines, colleges are likely to enroll more minority high school graduates.

The growth in the number of Hispanic high school graduates of both sexes and in the number of Black male high school graduates during the 1980s suggests that these groups will represent larger proportions of those enrolled in higher education in the 1990s. The growth in high school completion rate in the Black population, especially among Black males, has reduced considerably the difference in the proportion of Black and White students who complete high school, although the gap has not been completely eliminated. Unfortunately, high school completion rates for Hispanic students remain low. Research is needed to identify factors that have contributed to the increase in the high school completion rate among Black males so these efforts can be continued and furthered. Research is also needed to determine if specific Hispanic subpopulations (e.g., Mexican Americans, Puerto Ricans, Central and South Americans, etc.) exhibit low high school completion rates and to identify programs that successfully raise the high school completion rates in these groups. It may be especially useful to investigate the extent to which recency of immigration is related to high school completion rates for both Hispanic and Asian American subpopulations.

Minority Participation in Undergraduate Education

Trends in undergraduate enrollments show marked differences among minority groups, not only in participation rates but also in the types of institutions they attend and the fields of study they choose.

Participation Rates and Enrollments. It is necessary to differentiate here between participation rates and enrollment figures. Participation rates are percentages. The percentage can be based on the number of students in a given age cohort who are currently enrolled in college or who have ever been enrolled in college or on the number of high school graduates enrolled in college. Enrollment figures are the actual number of students currently enrolled in higher education.

Vining Brown's analysis for the period 1975-84 revealed the following patterns:

- o After steady growth for seven years, enrollments for Blacks and American Indians began to decline in 1982. Black student enrollment decreased by more than 11 percent between 1980-84, while American Indian students showed a 6 percent decline between 1982 and 1984.

- o Hispanic student enrollments grew during this period but slowed significantly between 1982-1984.

- o Asian American students made the most growth, almost doubling their numbers in the nine-year period, although they too showed a slower, but significant, growth pattern after 1982. Indeed, the lowest growth rate for Asian Americans (1982-1984) was still higher than the highest enrollment gains for Blacks and American Indians for the entire nine years.

- o During the nine-year period, total enrollments grew by almost 11 percent, with White enrollments increasing by 7.6 percent; Hispanic

enrollments by 37.7 percent; Asian American enrollments by 92.9 percent; and American Indian enrollments by 9.2 percent. However, Black enrollments declined by 3.6 percent during this period.

o During that same time period, American Indian enrollments as a proportion of total enrollment stayed virtually constant at 0.7 percent, while the proportion of Hispanic enrollments increased slightly (3.4 percent in 1976 to 4.2 percent in 1982) and the Asian American proportion almost doubled (1.8 percent to 2.8 percent). Black enrollments as a percentage of total enrollment declined from 9.4 percent in 1976 to 8.8 percent in 1982.

Recent data show that the rate of minority participation in higher education continues to be below that for White students (Carter & Wilson, 1992). While 25 percent of all Black youths and 16 percent of all Hispanic youths age 18-24 participated in higher education in 1990, 33 percent of White youths in this age cohort did so. Participation rates for Blacks and Whites in this age cohort rose in the decade between 1980-90, but the rate for Hispanic students showed a slight decline.

When higher education participation rates are restricted to high school graduates in the age 18-24 cohort, we find 33 percent of Blacks, 29 percent of Hispanics, and 39 percent of Whites enrolled in higher education in 1990. While participation rates among Black and White high school graduates increased during the decade, the rate for Hispanic high school graduates showed little change. These data are summarized in Table 2.

The total minority enrollment in higher education increased by 10 percent between 1988-1990 while White (non-Hispanic) enrollments rose only 3.8 percent (NCES, 1991). The total number of Blacks enrolled in higher education rose by 8.2 percent during this two-year period, while the increase among Hispanics was 11.5 percent American Indian enrollments grew by 10.8 percent between 1988-1990 while Asian American enrollments grew by 11.7 percent. The NCES data differ from data in the CPR because they include students of all ages, not only those in the age 18-24 cohort.

Focusing on the 18 to 24 age cohort may lead to an underestimate of the size of the higher education population. It is projected that, by the year 2000, students age 25 and older will comprise half of those enrolled in higher education (Levine & Associates, 1989). In 1987, students age 25 and older constituted 35 percent of the bachelor's degree recipients (National Center for Education Statistics, 1987). Many of these older students come from minority backgrounds. They are an increasingly important source for graduate schools' recruitment efforts.

During much of the 1980s, there was concern about the increasing gender gap in college enrollments and participation rates of Black and Hispanic men and women. Recent data (Carter & Wilson, 1992) indicate the gender gap in college enrollments and participation rates appears to be closing for Blacks, but gender differences persist among Hispanics. Table 2 shows 1980 and 1990

Table 2

College Enrollments and Participation Rates for Black, Hispanic, and White High School Graduates in the Age 18-24 Cohort, 1980 and 1990, and Changes in Enrollment and Participation Rate Between 1980-90

(Sum of male and female enrollments may not equal total because of rounding.)

	Enrollment (Thousands)			Participation Rate (Percent)		
	1980	1990	Change	1980	1990	Change
BLACK - Total	715	894	+179	27.6	33.0	+5.4
Females	422	467	+45	28.6	31.8	+3.2
Males	293	426	+133	26.3	34.4	+8.1
HISPANIC* - Total	327	435	+106	29.8	29.0	-0.8
Females	165	221	+56	28.5	29.7	+1.2
Males	160	214	+54	30.9	28.4	-2.5
WHITE - Total	6,423	6,635	+212	31.8	39.4	+7.6
Females	3,147	3,344	+197	29.9	38.6	+8.7
Males	3,275	3,292	+17	33.8	40.3	+6.5

* Hispanics can be of any race.

Source: Carter and Wilson, *Minorities in Higher Education*, ACE, 1992

enrollments and participation rates for male and female Black, Hispanic, and White high school graduates in the age 18-24 cohort. Although college enrollment figures for Black male high school graduates age 18-24 are still somewhat below those for Black females, the participation rate for Black males increased much more rapidly during the 1980s than it did for Black females. Among Hispanics, the number of males in the age 18-24 cohort enrolled in higher education was below the number of females in both 1980 and 1990. The participation rate for Hispanic females increased slightly during the decade, but the participation rate for Hispanic males declined.

College enrollments of minority males rose by 9.4 percent in the period from 1988-1990, while enrollments of White males rose by 2.7 percent (NCES, 1990). Enrollments increased by 11 percent for Hispanic males, 10.8 percent for Asian American males, 10.3 for American Indian males, and 7.4 for Black males. College enrollments of minority females increased by 10.5 percent in this same two-year period, while enrollments of White females increased by 4.7 percent. Enrollments increased by 13.2 percent for American Indian females,

13.1 percent for Asian American females, 11.9 percent for Hispanic females, and 8.7 percent for Black females.

The data on minority participation in undergraduate education suggest the need for research to identify factors that have contributed to the increase in the higher education participation rate in the Black population, especially among Black males, so these gains can be maintained. The data also suggest the need for research with Hispanic subpopulations to determine if the lack of change in college participation rate is characteristic of any given subgroup. This research can also identify factors that facilitate college participation for each subpopulation.

Particular attention needs to be given to the role of financial aid in college access. Orfield (1992) contends that access of minority and low-income students to college is declining because of financial aid policies. Instead, he states "financial aid is going to middle class students who could manage without it." In addition, students most in need of financial aid are the least likely to know about the system, least likely to have adequate high school counseling, and most likely to have parents without an understanding of the alternative, or parents who are living separately and are unwilling to cooperate (College Entrance Examination Board, 1981). Minority and low income high school seniors are less willing to consider borrowing for their education than majority and more affluent students (Ekstrom, 1992). This reluctance to borrow is associated with lower rates of college attendance and, if the student does attend college, attendance on a part-time rather than a full-time basis or attendance at a two-year rather than a four-year college.

Type of Institution Attended. When Vining Brown examined college enrollment by type of institution attended, she found:

- o In comparison to White students, minority students were more likely to enroll in two-year than four-year institutions. Among minorities, American Indian and Hispanic students were most likely to do so and Asian American and Black students least likely. Data from the National Center for Education Statistics (NCES, 1989) show that in 1986, 57 percent of all American Indian and 55 percent of all Hispanic students were enrolled in two-year institutions.

- o Asian American and White students were slightly more likely to enroll in private institutions, with one exception: Black students enrolled in two-year and four-year private institutions at about the same rate as White students, reflecting the enrollments of Black students at traditionally Black institutions.

More recent data (NCES, 1991) show little change in these findings. Overall, about 45 percent of the minority students enrolled in higher education in 1990 were in two-year colleges, as compared to 37 percent of White students. Fifty-five percent of Hispanic students and 52 percent of American Indian students enrolled in higher education attended two-year colleges. For Black students, the comparable figure was 42 percent; for Asian American students, 38 percent.

There is a need for research to compare the rate of transfer from two-year to four-year colleges among minority students who aspire, at college entrance, to attain a bachelor's degree and/or enter graduate education. This research also needs to identify individual and institutional factors that facilitate transfer from two-year to four-year institutions and continuation into graduate education.

Minority students, as well as White students, enroll in public colleges and universities more often than private institutions (NCES, 1991). This was true in 1990 for Black, Hispanic, American Indian, and Asian American students. In 1990, 2,135,000 minority students were enrolled in public colleges and universities; 502,000 were enrolled in private colleges and universities. Between 1988-90, minority enrollment in private institutions grew by 13.3 percent, while minority enrollment in public institutions grew by 9.2 percent. The largest growth during this two-year period was in the enrollment of Asian American and Hispanic students in private colleges.

Data from the GRE applicant pool indicate that historically Black colleges and universities (HBCUs) produced a substantial proportion of the Black participants in graduate education for the years represented. Figures from 1977 and 1985 show that between 34 and 41 percent of all Black GRE test takers attended historically Black colleges. Yet during that same period, enrollments on Black college campuses accounted for fewer than 20 percent of all Black students enrolled at baccalaureate-degree-granting institutions. Because enrollments at HBCUs have climbed steadily since 1986 and are at an all-time high, the role of Black institutions in the production of Black talent and as significant contributors to the graduate education minority pool cannot be overlooked in the development of a research agenda (Trent, 1991).

Enrollments in HBCUs grew by 7.8 percent between 1988-90. While Black students continue to be the largest group enrolled in HBCUs, it should be noted that nearly 30,000 White students were enrolled in these institutions in 1990 and that White enrollments at HBCUs increased by 14.9 percent between 1988-90 (Carter & Wilson, 1992).

A study of top degree producers (*Black Issues in Higher Education*, 1992) identified colleges and universities that awarded large numbers of bachelor's degrees to minority students in 1988-89. The study named both HBCUs and predominantly White institutions awarding the largest number of degrees to Black students, as well as institutions awarding the largest number to Hispanic, Asian American, and American Indian students.

The number of minority students receiving a bachelor's degree from a given institution is a function of the number of such students entering that institution plus the ability of the institution to retain them. Recent data collected by Division I of the National Collegiate Athletic Association (NCAA) revealed that, in 256 of these institutions, only 31 percent of Black students who entered as freshmen in 1984 had received a bachelor's degree by 1990. (Fewer Black students get bachelor's degree in four years, according to the *Chronicle of Higher Education*, July 15, 1992.) Comparable data for other racial/ethnic groups was 29 percent for American Indian students, 40 percent for Hispanic students, 56 percent for White students, and 62 percent for Asian

American students. More research is needed to determine the characteristics of institutions that are successful in retaining and graduating minority students. Inspection of the NCAA data reveals that some institutions producing large numbers of minority students who earn bachelor's degrees are not graduating minority students at the same rate as other students. For example, the University of Maryland - College Park, the predominantly White institution awarding the largest number of bachelor's degrees to Black students in 1988-89, had graduated by 1990 only 37 percent of the Black students who entered as freshmen in 1984, as compared to a 57 percent graduation rate for the institution at large.

Graduation Rates and Fields of Study. Vining Brown found a slight increase between 1976-85 in the percentage of bachelor's degrees awarded to American Indian, Asian American, and Hispanic students, but the total of these groups represented slightly more than 5 percent of the total baccalaureate pool. The proportion of Black students among baccalaureate degree recipients declined from 6.5 percent to 5.9 percent. Of greater significance to graduate education are the absolute numbers. In 1976, 58,515 Black students received bachelor's degrees, but in 1985 that number fell by 12 percent, to 51,466. This occurred at a time when the White student pool declined by 5 percent and the numbers of Hispanic and Asian American graduates rose by 33 percent and 68 percent, respectively. Even though the number of Black bachelor's degree recipients rose to 56,555 in 1986, Black degree attainment was still 3 percent below the 1976 level (NCES, 1989).

In 1989, minority individuals constituted 12.8 percent of bachelor's degree recipients. Black students represented 5.7 percent of all bachelor's degree recipients, Asian American students 3.8 percent, Hispanic students 2.9 percent, and American Indian students 0.4 percent (Carter & Wilson, 1992).

Data on the total number of bachelor's degree awards in the period 1987-89 (Carter & Wilson, 1992) show an increase of 2.4 percent, but the number of degrees awarded to minority individuals grew by 8.3 percent. Growth in the number of bachelor's degrees in this two-year period was highest among Asian American and Hispanic individuals (17.2 and 10.4 percent, respectively). The number of Black bachelor's degree recipients increased by 2.6 percent, the number of American Indian recipients, by 1.9 percent.

It is important to note that most of the increase in the total number of bachelor's degrees awarded was among female students, whose percentage rose by 4.5 percent, compared to an increase of only 0.2 percent for males. While the number of bachelor's degrees awarded to Asian American and Hispanic males and females rose, the increase was larger for females. Among Blacks and American Indians, there was a small decrease in the number of bachelor's degrees awarded to males, but the number awarded to females increased.

Vining Brown's analysis revealed differences among minority groups in their field choices and also showed clear shifts within groups in terms of career interests:

- In general, non-Asian American minorities pursuing a bachelor's degree were more likely than their Asian American counterparts to earn

their degrees in education or the social and behavioral sciences. They were equally likely to earn degrees in business, but considerably less likely than their Asian American peers to pursue science/technology majors.

o Between 1977-85, there were some significant shifts in fields of study, with decreases for all minority groups in education and the social and behavioral sciences and increases in science/technology fields. Choice of business as a major increased for all groups.

Trends in undergraduate field choice have considerable significance for minority graduate education. Table 3 summarizes some of the data regarding field choice at the bachelor's degree level. Between 1976-89, the number of bachelor's degrees in education awarded to minority students declined by 56 percent and the number of degrees in the social sciences by 7 percent (Carter & Wilson, 1992). As Vining Brown has pointed out, both education and many social science majors (i.e., psychology, sociology, economics) lead to careers in fields that often require graduate education. During 1976-89, the number of bachelor's degrees in engineering awarded to minority students increased by 290 percent, while business degrees increased by 118 percent, degrees in the health professions by 58 percent, and degrees in the biological and life sciences by 38 percent. But, as Vining Brown points out, occupations in business and engineering have high entry rates for individuals with baccalaureate degrees. The increases in fields less likely to require graduate education and the decreases in fields more likely to require it suggest that there would be a decline during this period in the number of minority students entering graduate education.

By 1989 business had become the field attracting the largest number of bachelor's degree students, regardless of race/ethnicity. When analyses are restricted to the fields shown in Table 3, the social sciences were the second most popular major field area among Black and Hispanic students, but engineering was the second choice among Asian American students, and education was second among American Indian students. There was an increase for all racial/ethnic groups in the number of bachelor's degrees awarded in business, engineering, and the health professions. The number of degrees awarded in biological/life sciences increased for all groups except Blacks. Bachelor's degrees in the social sciences increased among Asian American and Hispanic students but decreased among Black and American Indian students. The number of bachelor's degrees in education decreased for every group except Asian American students.

It should be noted that other data on this topic differs somewhat from the American Council on Education (ACE) data, apparently because of differences in data sources and updating. For example, the National Science Foundation (NSF) publication *Women and Minorities in Science and Engineering: An Update* (White, 1992) indicates that 275 American Indians; 3,154 Blacks; and 3,168 Hispanics received bachelor's degrees in engineering in 1989, while the ACE figures are 285; 3,237; and 2,458, respectively.

Vining Brown concluded that, in general, undergraduates are moving away from fields that commonly require graduate education and instead are flowing

into majors linked to specific occupations (i.e., computer science, engineering, business administration) where the job market for baccalaureates tends to be good.

Table 3

Number of Minority Bachelor's Degree Recipients in Selected Major Fields, 1976 and 1989, and Percent Change

	Bio./Life Science	Business	Educ.	Engin.	Health Profess.	Social Sci.
AMERICAN INDIAN						
1976	143	426	742	150	166	513
1989	147	824	537	285	245	431
% change	2.8	93.4	-27.6	90.0	47.6	-16.0
ASIAN AMERICAN						
1976	1,217	1,829	776	971	847	1,388
1989	2,951	8,039	1,127	7,012	1,733	3,992
% change	142.5	339.5	45.2	622.1	104.6	187.6
BLACK						
1976	2,326	9,489	14,209	1,370	2,741	10,978
1989	1,944	15,088	4,233	3,237	3,973	6,498
% change	-16.4	59.0	-70.2	136.3	44.9	-40.8
HISPANIC*						
1976	873	2,467	2,831	841	901	3,032
1989	1,254	6,987	2,293	2,458	1,386	3,618
% change	43.6	183.2	-19.0	192.3	53.4	19.3

* Hispanics may be of any race.

Source: Carter and Wilson, 1992

Participation of Minorities in Graduate Education

Enrollment. Vining Brown's analysis of graduate participation rates based on the HEGIS data for the nine-year period 1976-84 reflects some of the changes observed at the undergraduate level:

- o Full-time graduate and professional school enrollments declined for Black students but increased for Hispanic students, while White students showed declines similar to those of Black students. Enrollments for Asian Americans, American Indians, and nonresident aliens also showed significant increases.

- o The numerical and proportional decline for full-time Black graduate school enrollees (18 percent) was four times that of their White counterparts (4.2 percent). Hispanic students' full-time enrollments increased by more than 58 percent during this period.

- o The most dramatic changes took place in graduate business school enrollments and were in sharp contrast to enrollment trends for other professions. Among Black students, there was a 34 percent increase in business school enrollments; for Hispanic students, a 102 percent increase; for White students a 24 percent increase.

According to data from the U.S. Department of Education, graduate enrollments grew from 1.3 million in 1977 to an estimated 1.5 million in 1990. The overall annual growth rate in graduate education between 1977-84 was 0.3 percent; between 1984-90, 3.6 percent. Projections are that graduate enrollments will increase by 1.9 percent a year between 1990-96 but by only 0.6 percent between 1996-2002 (Gerald & Hussar, 1991).

Graduate school enrollments for minority students grew more rapidly than those for White students between 1988-90. White enrollments increased by 5.9 percent while total minority enrollments increased by 12.0 percent. All minority populations except American Indians showed an increase in graduate enrollments during this period. Enrollments of Hispanic students increased by 17.9 percent, Asian Americans by 13.0 percent, and Blacks by 12.0 percent. Enrollments of nonresident aliens, who are not included in the U.S. minority figures, increased by 9.3 percent.

Despite gains in minority students, they represent a small portion of total graduate enrollments. There were approximately 1,221,000 White graduate students in 1990 but only 187,000 minority graduate students; minority graduate students were approximately 11.9 percent of the total graduate enrollment.

There has been a severe underrepresentation of Black and Hispanic students in graduate programs in engineering, mathematics, and science (Thomas, 1992). Traditionally, Black colleges and universities have played an important role in producing Black graduate students in mathematics, life and physical sciences; however, predominantly White colleges and universities lead in the production of Black graduate students in engineering. Because very few institutions produced more than two Black or Hispanic doctoral recipients in

engineering, the life sciences, and the physical sciences, Thomas concluded that "there are no real leaders among U.S. colleges and universities in the production of African American and Latino doctorates in scientific and technical fields."

Professional school enrollments increased by 2.6 percent between 1988-90. While there was a small decline (-0.4 percent) in enrollments among White students, minority enrollments increased by 17.9 percent. Enrollments among Asian Americans increased by 28.6 percent, among Blacks by 14.3 percent, and among Hispanics by 11.1 percent. In 1990 there were approximately 222,000 White students and 46,000 minority students enrolled in professional schools; minority students were approximately 16.8 percent of the total professional school enrollment.

Degree Attainment. During the middle of the 1980s the number of graduate degrees awarded to United States citizens declined but, by the end of the decade the trend appeared to be reversing. Doctorates dropped from 25,221 in 1980 to 22,991 in 1987 before increasing to 24,190 in 1989 (National Research Council, *Doctoral Records File* as reported in Carter and Wilson, 1992). Master's degrees dropped from 294,183 in 1981 to 253,469 in 1985 before increasing to 274,800 in 1989 (U.S. Department of Education, *Race/Ethnicity Trends in Degrees Conferred by Institutions of Higher Education*, 1991).

The minority share of the doctorates awarded to U.S. citizens in 1980 increased from 7.8 percent to 9.3 percent in 1990, but these increases were not uniform across minority populations. In 1980 Black students received 4.1 percent of these doctorates, Asian American students 1.8 percent, Hispanic students 1.6 percent, and American Indian students 0.3 percent. In 1990 Black students received 3.4 percent of these doctorates, Hispanic students 2.9 percent, Asian American students 2.6 percent, and American Indian students 0.4 percent.

At the master's degree level, minority students' share of the degrees inched forward from 9.9 percent in 1976 to 10.9 percent in 1989. Black students received 6.6 percent of the degrees in 1976 but only 4.6 percent in 1989. During the same period, Hispanic students' share of master's degrees increased from 1.7 percent to 2.4 percent, Asian American students' from 1.3 to 3.5 percent, and American Indian students' from 0.3 to 0.4 percent.

Between 1987-89 the number of master's degrees awarded increased by 6.8 percent. This increase was larger among minority students (8.6 percent) than among White students (5.6 percent) and reflects a dramatic increase in the number of master's degrees awarded to Asian American students. While the number of master's degrees awarded to Asian American students grew by 25.2 percent, the number awarded to Hispanic students increased by 3.2 percent, to American Indian students by 2.6 percent, and to Black students by 1.5 percent.

By 1991 universities in the United States were awarding a record number of doctoral degrees, primarily because of growth in the number of foreign degree recipients. Foreign students received 30.1 percent of all Ph.D.s awarded in this country in 1991. Among doctorates awarded to U.S. citizens,

89.6 percent were awarded to White students and 10.4 percent to minority students (Chronicle of Higher Education, May 13, 1992, reporting data from the National Science Foundation). While the percentage of minority doctorates increased slightly, the number remained low. Only 2,521 minority individuals who were U.S. citizens received a Ph.D. in 1991.

The number of United States citizens receiving the doctorate was relatively stable between 1990-91 (a decrease of 0.7 percent) but showed a small decrease (1.4 percent) from 1981-91. This decrease was concentrated among White and Black individuals. There was a 7.9 percent decline in the number of Black Ph.D. recipients and a 0.6 percent decline in White Ph.D. recipients between 1981-91. During this same period, there was a 63.9 percent increase in the number of Asian American Ph.D.s, a 52.6 percent increase in the number of Hispanic Ph.D.s, and a 50.6 percent increase in the number of American Indian Ph.D.s.

Recent data (Chronicle of Higher Education, May 13, 1992, reporting data from the National Science Foundation) show that, after 10 years of declines in the number of Black students obtaining doctoral degrees, this trend appears to be changing. In 1991, 933 Black U.S. citizens received the doctoral degree, up by 4 percent from 1990 and 13.6 percent from 1989. However, the number of Black doctoral degree recipients was still small and below the 1981 level.

The fields in which graduate degrees were earned varied somewhat by racial/ethnic group. In 1976 education was the most popular choice of master's degrees for all minority students. It remained so in 1989, except for Asian American students, who were more likely to receive master's degrees in business or engineering. In 1976 business was the second most popular field for master's degrees for all minority groups except Blacks, who were more likely to receive a master's degree in public affairs. Business was the second most popular area for master's degrees in 1989 for all minority groups except Asian Americans. The number of minority students receiving master's degrees in selected fields in 1976 and 1989 is shown in Table 4, along with the percent change.

The number of master's degrees awarded to minority students from each racial/ethnic group increased in business, the health professions, and public affairs. The number of master's degrees awarded in engineering increased for all groups except American Indians. In the social sciences, the number of master's degrees in education declined among Black and Hispanic students but increased among Asian American and American Indian Students. The number of master's degrees in education declined for all groups except Asian Americans.

As mentioned earlier in the discussion of data on bachelor's degrees, other data sources, such as the NSF's Women and Minorities in Science and Engineering: An Update (White, 1992), contain slightly different numbers than those in the ACE report. For example, the NSF indicates that there were 35 American Indians, 401 Blacks, and 477 Hispanics who received master's degrees in engineering in 1989, while ACE indicates there were 37, 401, and 482, respectively.

Table 4

Number of Minority Master's Degree Recipients
in Selected Fields, 1976 and 1989, and Percent Change

	Business	Educ.	Engin.	Health	Public Affairs	Social Sciences
AMERICAN INDIAN						
1976	71	390	40	37	60	38
1989	197	386	37	85	102	53
%change+	177.5	-1.0	-7.5	129.7	70.0	39.5
ASIAN AMERICAN						
1976	727	905	500	215	194	200
1989	2,962	1,064	2,146	563	444	329
% change	307.4	17.6	392.2	161.9	128.9	64.5
BLACK						
1976	1,549	12,434	233	622	1,615	883
1989	3,077	5,272	424	854	1,788	397
% change	98.6	- 57.6	82.0	37.3	10.7	-55.0
HISPANIC*						
1976	502	2,241	228	175	437	285
1989	1,581	2,157	482	398	614	247
% change	214.9	-10.9	111.4	127.4	40.5	-13.3

+Data should be interpreted with caution because of the small number of cases in some fields.

*Hispanic individuals may be of any race

Source: Carter and Wilson, 1992

At the doctoral level, there were marked increases between 1980-90 in the number of degrees awarded to minority students in physical, life, and social sciences and in engineering. There were 132 physical science doctorates awarded to minority students who were U.S. citizens in 1980 and 219 in 1990. In 1980, 210 doctorates in the life sciences were awarded to minority

students; 323 were awarded in 1990. There were 265 doctorates in the social sciences awarded to minority students in 1980 and 441 in 1990. In engineering 105 doctorates were awarded to minority students in 1980 and 223 in 1990. The number of humanities doctorates remained steady; 219 were awarded to minority students in 1980 and 220 in 1990. The number of minority doctoral degree recipients in education declined from 843 in 1980 to 690 in 1990.

More detailed data, showing the number of doctorates awarded in 1980 and 1990 for each minority population, are presented in Table 5. Percent change is not shown in this table because of the small numbers. The largest increase in the number of doctorates awarded to American Indians was for the social sciences. But there were still very few doctorates awarded to American Indians. During this decade, education doctorates awarded to American Indians declined. Among Asian Americans, the largest increase in doctorates occurred in engineering. The number of Asian Americans receiving doctorates in the

Table 5

Number of Doctoral Degrees in Selected Fields
Awarded to U.S. Citizens from Various Minority Groups, 1980 and 1990

	Physical Science	Engin.	Life Science	Social Science	Humanities	Educ.
AMERICAN INDIAN						
1980	5	3	7	13	3	43
1990	5	4	8	23	8	37
ASIAN AMERICAN						
1980	75	73	102	79	40	65
1990	108	152	149	82	34	61
BLACK						
1980	25	11	65	180	97	591
1990	23	28	63	172	70	420
HISPANIC*						
1980	27	18	36	93	79	144
1990	83	39	103	165	108	172

* Hispanic individuals may be of any race

Source: National Research Council, Doctorate Record Files, as reported in Carter and Wilson (1992)

humanities and in education declined. During the 1980s, there were small declines in the number of doctorates awarded to Blacks in the physical, life, and social sciences and larger declines in education and the humanities. There was an increase in the number of Blacks receiving doctorates in engineering. Among Hispanics the number of doctorates awarded in every field increased.

Data on some graduate degree areas not included in Tables 4 and 5 are available from the study of top degree producers (Black Issues in Higher Education, 1992). This study ranks psychology second in terms of doctoral degrees awarded to Black, Hispanic, and American Indian students in 1988-90.

An examination of changes in the number of doctoral degrees awarded to individuals from some Hispanic subpopulations (Puerto Rican, Mexican American, other Hispanics) is shown in Table 6. There were increases in every field in the number of doctorates awarded to individuals of Puerto Rican, Mexican American, and other Hispanic backgrounds except in the case of education degrees awarded to Mexican Americans, where there was a small decrease.

Table 6

Number of Doctoral Degrees in Selected Fields
Awarded to Individuals from Various Hispanic Subpopulations, 1980 and 1990

	Physical Science	Life Science	Social Science	Humanities	Education
PUERTO RICAN					
1980	5	3	17	12	24
1990	32	41	45	29	55
MEXICAN AMERICAN					
1980	6	6	21	14	51
1990	17	35	41	18	47
OTHER HISPANIC					
1980	16	27	55	53	69
1990	40	43	83	60	70

Source: National Research Council, special tabulations from the Doctoral Record File, 1980 and 1990.

Older students are an often overlooked population in pipeline studies of graduate education. Brazziel (1992) found that students who were age 25 or older at the time they received their bachelor's degree comprised 14.3 percent of U.S. citizen doctoral degree recipients in the period 1988-90. The proportions of Black, Mexican American, other Hispanic, and Alaskan/American Indian older students receiving the doctorate were double those of regular age students from these racial/ethnic groups. We need to know more about how faculty perceive and interact with older students, especially if age and minority status combine to lower faculty expectations.

Older students tend to select different fields than students who have progressed through the education pipeline in a more typical manner. Brazziel (1992) found older students significantly more likely to have received doctorates in education and the social sciences than regular age students and less likely to have received doctorates in the life sciences, physical sciences, and engineering.

Analysis of the postgraduate plans of minority Ph.D. recipients (Brown, 1988) shows that they are not pursuing the traditional occupations leading to college teaching and research careers. Indeed, in 1986, minorities earned 34 percent of all doctorates in education, but only 9 percent had definite plans to pursue an academic career. The findings were similar for minority Ph.D. recipients in other career fields. Industry and government are the primary competitors for new minority doctorates.

In summarizing her analysis of pipeline trends, Brown (1987) concluded:

> ... there are clear differences in the enrollment and degree trends among minorities at different levels of the undergraduate-graduate pipeline and among career fields. Moreover, the findings indicate that among the possible factors closing off the participation of Blacks and Hispanics in graduate education is their choice of career fields with high labor force participation rates after the bachelor's degree, their growing interest in professional education, and their lower participation in fields requiring advanced study.

II. FACTORS CONTRIBUTING TO THE UNDERREPRESENTATION OF MINORITIES IN GRADUATE EDUCATION

A look at the education pipeline helps us understand the potential size and composition of the graduate school pool, but as Nettles (1987) points out:

> The gap between minority representation among bachelor's degree recipients and their representation among graduate enrollments and graduate degrees awarded is an indication of problems relating to access and success in graduate school that go beyond simple educational pipeline suggestions...

The demographics do not explain the processes that created them. For an explanation of these processes, we turn to research on minorities in higher education. The following section describes research that informs our understanding of factors limiting minority participation in graduate education. The section is divided into three parts: preadmission issues, graduate admission and enrollment issues, and retention and completion issues. It is important to note the paucity of research on minority students, however, especially on minorities in graduate education. When this problem receives attention it typically deplores the low number, rather than offering explanations and solutions. For example, Bowen and Rudenstine's extensive study of graduate education (1992) includes only a brief discussion of the low number of minority students receiving doctorates and a recommendation that the federal government do more to encourage minority students to obtain arts and sciences doctorates.

Much of the material in the following section is derived from reviews by Clewell and her colleagues (Clewell, 1987; Thomas, Clewell, & Pearson, 1992) and from the publications of the Council of Graduate Schools (1989, 1992a, 1992b, 1992c).

Preadmission Issues

Graduate education is dependent on the supply of students produced by undergraduate colleges and universities. This section discusses two major issues affecting the supply of minority undergraduates who might enroll in graduate or professional education: 1) retention and completion of the bachelor's degree by these students, and 2) factors influencing these students' decisions about beginning graduate education.

Undergraduate educational experiences and minority student retention. Minority students attending predominantly White colleges and universities often find themselves in an alien environment. Many times there is a poor fit between students' personal needs, goals, and expectations and the demands and supports provided by the college. Studies of Black students in predominantly White colleges and universities found they had low levels of satisfaction (Allen, 1981; Gibbs, 1982), greater feelings of isolation (Fleming, 1984), weaker identification with the institution (Allen, Bobo & Fleuranges, 1984), and were more likely to experience feelings of alienation (Suen, 1983) than their White classmates. Suen found these feelings of alienation were related to attrition.

Research is needed to identify factors contributing to the successful adjustment of minority students to predominantly White campuses. Thompson and Fretz (1991) found that Black students' academic and social adjustment on a predominantly White campus was related to bicultural adaptive strategies, including having cooperative attitudes and a need to establish social cohesion or a sense of community. Allen (1992) views Black student outcomes as resulting from a two stage process involving both the characteristics of the individual and the characteristics of the institution. These combine to influence academic performance, extent of social involvement, and occupational goals. Allen is concerned with how the student perceives the campus situation, how the student handles various situations, and the student's adeptness in help-seeking situations.

There is also a need to study factors contributing to retention of minority undergraduates because their attrition rate is considerably higher than that of White students. It is important to note that when Black students attend a historically Black college or university (HBCU) they are more likely to receive a bachelor's degree within seven years than if they attend a predominantly White institution (Ehrenberg & Ives, 1993). Retention at the undergraduate level is related to a number of factors, including preadmission characteristics (such as family background and prior education), student goals and commitment, institutional experiences, and institutional efforts to ameliorate some of the adverse circumstances minority students face. (See Clewell & Ficklen, 1986, for a review of the literature on institutional efforts to improve conditions for minority students.)

One of the best-known theories about student attrition from college is Tinto's Student Integration Model (1987). This model includes effects from both the academic system (academic performance, faculty/staff interactions) and the social system (extracurricular activities, peer-group interactions) that determine the academic and social integration of the individual within the institution. This integration, together with pressures from external commitments, interacts with a student's goals and intentions, leading to retention in or departure from college.

A different and competing theory proposed by Bean and his colleagues (Bean, 1980; Bean 1983; Bean & Metzner, 1985) is the Student Attrition Model. This model emphasizes the role of attitudes, institutional factors, and family approval on students' decision to withdraw from college. One aspect of this model involves student dependency, which includes both parental encouragement and approval and the encouragement of high school mentors. Bean and Vesper (1992) report that students who did not depend on parental approval were more likely to drop out of college than those who were dependent on it. The role of student dependency in college persistence needs to be examined further, especially its validity for various racial/ethnic groups and for students from different socioeconomic levels.

Recently Cabrera, Castañeda, Nora, and Hengstler (1992) developed a model of student persistence that combines Tinto's and Bean's theories. They concluded both are correct in assuming that college persistence is the product of a set of complex interactions between a student and an institution. Tinto's Student Integration Model appeared somewhat more robust than Bean's

Student Attrition Model in terms of the number of hypotheses validated. Almost 70 percent of the hypotheses based on Tinto's theory were confirmed, compared to 40 percent of the hypotheses based on Bean's theory. However, the Student Attrition Model accounted for 44 percent of the variance in persistence, while the Student Integration Model accounted for only 38 percent; the Student Attrition Model also accounted for more of the variance in intent to persist (60 percent, as compared to 36 percent for the Student Integration Model). The two theories appear to be complementary, rather than mutually exclusive. A structural equations modeling test of the integrated model of student retention (Cabrera, Nora & Castañeda, 1993) concluded that a better understanding of the persistence process can be obtained by combining the two theories. The effect of the environmental factors on socialization and academic experiences of students was far more complex than was represented in Tinto's Student Integration Model. The largest direct effects on persistence were from intent to persist, grades, institutional commitment, and encouragement from family and friends. Goal commitment, academic integration, financial attitudes, and social integration also made important contributions to persistence. There is a need to test both the Bean and the Tinto models, as well as the integrated model, to determine their appropriateness for minority students. One such study (Pavel & Padilla, 1993) found a weak fit between the Tinto model and postsecondary departure of American Indian and Alaskan Native students.

Attrition among minority students may be due, in part, to the fact that they are more likely to have experienced inferior education prior to college. However, Loo and Rolison (1986) found minority students were less likely than White students to drop out of predominantly White institutions for academic reasons but more likely to attribute dropout to lack of support or social and emotional dissatisfaction. Persistence among these students is also related to their familiarity with academic requirements and the demands of the institution (Tracey & Sedlacek, 1985). Moreover, these authors found the non-cognitive components of academic integration were more important for Black students than White students, leading Tinto to comment, "Having the requisite skills for persistence is one thing. Being able to apply them in perhaps strange settings is another." (Tinto, 1987, p. 70).

Minority students who do not attend HBCUs often find it difficult to find and become part of a supportive community or mainstream intellectual life (Loo & Rolison, 1986). One problem is that many predominantly White colleges and universities do not have large enough numbers of minority students, to allow such communities to be formed. Complicating matters still further, the process of social integration may be different for minority and White students. For example, Pascarella (1985) found that social integration of Black college students was more influenced by formal structures, such as extracurricular activities, than informal ones.

Minority college students experience more stress than their majority classmates, which is related to their academic progress and performance. Muñoz (1986) found that Chicano undergraduates experienced more stress than Anglos; this was higher for females than males. Chicana college students reported significantly higher levels of stress related to their academic preparation and their economic situation than did Chicano males; the women

also reported significantly lower levels of parental support (Chacón, Cohen, & Strover, 1986). Smedley, Myers, and Harrell (1993) found that minority status created additional stress for college freshmen and was associated with poorer academic performance; however, it did not affect performance as much as aptitude did. D'Augelli and Hershberger (1993) found that Black students arrived on a predominantly White campus knowing significantly fewer people on campus than their White classmates; the Black students also differed significantly from their White classmates in general well-being and life satisfaction.

The pipeline data in the previous section alerts us to the importance of pipeline transitions. Minority students who go on to attain the doctorate are more likely to begin their postsecondary education in junior or community colleges than are White students. In a study of minority doctorates currently in progress, Vining Brown has found that 27 percent of Mexican American, 21 percent of American Indian, 19 percent of other Hispanic, and 11 percent of Black Ph.D.s began their college career in a two-year institution (as compared to 10 percent of all Ph.D.s). A variety of institutional partnership programs, such as articulation agreements, have been put in place to improve transfer from two-year to four-year colleges (Council of Graduate Schools, 1992b). Brazziel (1992) found that over 25 percent of the older students who attained a doctorate had begun their college careers in junior or community colleges. It would also be useful to study doctoral recipients who began their education in junior or community colleges to identify obstacles and facilitators for this population.

Many minority graduate students take a considerable amount of time off between attainment of their baccalaureate degree and entrance into a doctoral program. More research is needed on the characteristics, activities, and decision processes of students who do not proceed immediately to graduate school. We also need a better understanding of the various pathways minority students take to graduate school.

Tierney (1992) has taken issue with much of the traditional research on student attrition from college. He contrasted two approaches to research on undergraduate student attrition, especially as it relates to the experience of American Indian students, and advocates an approach based on critical theory and empowerment. The traditional approach to research on student attrition, which has its theoretical basis in functionalism and student integration, is student centered and tends to be quantitative. It views attrition as resulting when students are unable to negotiate the collegiate experience effectively. Findings from such research tend to cite inadequate academic preparation, lack of motivation, lack of family support and encouragement, and lack of financial aid as the causes of attrition. In contrast, research that takes as its theoretical basis critical theory and empowerment, is institution centered and systemic. It tends to be qualitative, using methods such as case studies and ethnography to interpret Indian perceptions and views. Findings suggest that lack of societal and institutional commitment to Indian students, lack of relevant coursework and services, and cultural alienation are associated with attrition among American Indian undergraduates. Solutions, according to this approach, are to create organizational conditions for

empowerment, such as providing innovative programs (Indian studies, faculty training, student training and transition) or new institutions.

Factors affecting the graduate education decision. After earning a baccalaureate degree, students have several immediate options, including entering the labor force (full- or part-time) or going on to graduate or professional school (full-or part-time). As the preceding section noted, minority undergraduate students increasingly choose major fields and occupations that do not require additional graduate training.

Nettles (1987) identified four factors that may explain the lower participation rates of underrepresented minorities in graduate education: (1) the cost of graduate education; (2) the financial indebtedness of prospective graduate students; (3) the limited financial aid available for minority graduate students; and (4) the differential payoff of advanced degrees for various racial/ethnic groups.

Data on the financing of higher education is conflicting and there are sometimes concerns about its accuracy. While there has not been a comprehensive study of graduate school costs since the mid-1960s, Froomkin (1983) estimated that the median cost for full- time students in 1965 was $2,785 per year; the comparable figure in 1982 was $9,829 per year. Wilder and Baydar (1990) reported average annual costs of $7,460 for both full- and part-time students enrolled in 1987-88. They note, however, that the figures for part-time and full-time students were quite different: For example, average tuition costs reported by full-time students were $4,650, by part-time students $1,790. Wilder and Baydar urge caution in interpreting other cost data because of the large variances in responses and incomplete reporting in the "other expenditure" categories. They found it difficult to collect accurate cost information from respondents for several reasons: Many individuals do not keep good financial records, they report cost information for different time periods (e.g., 9, 10 or 12 months), and some do not know the amount of costs not directly incurred (e.g., tuition costs covered by fellowships or tuition waivers).

Several studies have examined the impact of undergraduate school debt on the decision to attend graduate school. In 1986, about one-half of college graduates left school owing money. Black college graduates were more likely to incur debt than White students, but their debt level was somewhat lower (Ekstrom, Goertz, Pollack, & Rock, 1991; Nettles, 1990). There does not appear to be a statistically significant relationship between undergraduate debt and decisions about applying to and/or attending graduate school (Boyd and Martin, 1985; Davis, 1986; Ekstrom, Goertz, Pollack, & Rock, 1991; Sanford, 1980; and Weiler, 1991). Because many of these studies relied on self-reported data and were limited by features of the data sources, most authors have expressed some caveats about their findings. However, it appears that debt alone does not deter students who have strong college records and aspirations for graduate education from enrolling in graduate programs, regardless of their race/ethnicity or socioeconomic status.

Among the students who were graduates of A Better Chance (ABC), a program designed to recruit and prepare minority students for entry into

exclusive boarding schools and elite colleges and universities, 40 percent entered graduate school immediately after college and another 50 percent expressed interest in graduate school attendance at some time in the future (Zweigenhaft & Domhoff, 1991). Students who entered graduate school with undergraduate debt took less time off between college and graduate school than their classmates, were more likely to attend graduate school full-time, and were more likely to be awarded graduate fellowships or assistantships (Nettles, 1990).

Graduate school costs, indebtedness, and financial aid may be marginal factors influencing a student's decision. Many students will first seek to determine whether the benefits of graduate school (potential increase in income and increased status) outweigh the costs (perceived lost income and direct costs) of graduate school. Nettles (1987) hypothesized that minority students had lower participation rates in graduate education because professional schools or direct entry into the labor market with a bachelor's degree were economically more favorable. He found, however, that minorities were severely underrepresented in professional programs; if every minority student choosing professional training went to graduate school instead, Black and Hispanic students would still be underrepresented. Professional education is more expensive than graduate education, so students in professional programs accumulate much greater indebtedness. In addition, employment in many professional fields has become less attractive in recent years because of such factors as oversupply of practitioners and professional restructuring resulting from economic factors. The more fundamental problem is that the pool of potential minority candidates is much larger than the number of applicants to either graduate or professional schools.

The literature concerning the labor market and graduate education reveals some evidence of differential economic gains by fields of graduate study - for example, economic benefits for advanced degrees in physics but not in library science (Ellis 1982; Van House, 1985). It is clear from Nettles' review (1987), however, that more attention should be given to the benefits and needs involved in minority students' decisions to attend graduate school, especially as they relate to likely graduate school costs and ultimate economic rewards.

Admission and Enrollment Issues

Admission to graduate school is a complex process involving a series of decisions by both prospective students and faculty and administrators in the institutions students want to attend.

Many minority students are uninformed about higher education and may have received no counseling or poor advice about college in secondary school. A similar situation probably exists with regard to information about graduate education and procedures for admission. Baird (1982) found that Black students tend to apply to fewer departments than Hispanic or White students. He also found that Black students applied to and were accepted by less prestigious departments, as were applicants with lower family incomes. Clewell (1987), in her study on minority persistence in graduate education, found that 52 percent of her respondents had applied to only one institution.

Attendance at a HBCU does not affect the probability of a Black student enrolling in graduate or professional school (Ehrenberg & Ives, 1993).

The Council of Graduate Schools (CGS) has found the following to be successful strategies for the identification of potential minority graduate students: (1) travel to historically Black colleges and universities and to predominantly White institutions that have large minority populations; (2) networking among colleges, universities, professional associations (such as occurs at the GRE/CGS Graduate Education Forums), as well as collaborations within a university; (3) follow-up telephone calls and letters from graduate school representatives or faculty members; and (4) faculty involvement in the identification of prospective graduate students in their departments (Council of Graduate Schools, 1992c).

Recruitment. Recruitment of students for graduate education differs from undergraduate recruitment in two important ways: (1) the potential graduate student is often recruited through referrals made by undergraduate institutions, departments, and/or faculty members; and (2) students apply to a department or program within an institution, not to the institution as a whole. Many graduate departments establish recruitment channels and rely on networking and collegial relationships that may not include minority faculty or predominantly minority institutions (Pruitt & Isaac, 1985).

Because the number of minority students who apply to graduate school is much smaller than the number of potential graduate students who are minorities, recruitment activities focusing on potential graduate students are a logical undertaking for institutions wishing to increase minority enrollment. Despite this, only about a quarter (28 percent) of the graduate schools responding to the 1992 CGS survey indicated they had a graduate minority recruitment policy (Council of Graduate Schools, 1992c). Examples of special minority recruitment efforts targeted at potential applicants to graduate schools have been described by Chandler (1988) and the Council of Graduate Schools (1992c). CGS has found the following activities to be successful in recruitment of minority graduate students: (1) advertising; (2) faculty involvement, such as writing to prospective students to describe the department and research interests; (3) student involvement, such as writing to prospective students to describe their experiences and meeting with prospective students when they visit campus; (4) monitoring the application and admissions process; and (5) providing financial support.

Recruitment of undergraduates from an institution's own minority students has been recommended as a useful strategy (Adams, 1988; Baird, 1990; Olson, 1988; Wagener, 1991) as has been recruitment from other near-by institutions and from institutions that have a pool of able minority undergraduates (Wagener, 1991). There have also been calls for an expanded role for graduate deans as well as faculty in minority recruitment (Hickey & Roozen, 1990). Recent research by Thomas, Clewell, and Pearson (1992) found that the six graduate institutions in their study placed more emphasis on recruitment of minority students than on their retention; nevertheless, they found no formal recruitment programs at the departmental level and only one formal recruitment effort at the institutional level. According to Thomas (1986), a survey by the Council of Graduate Schools (1984) indicated that

programs in law and medicine were three times more likely to have minority recruitment programs than were graduate programs in the arts and sciences.

Recruitment efforts by graduate institutions give minority students information about graduate admission procedures while allowing institutions an opportunity to identify talented candidates. Successful recruitment programs for minority students have usually involved (1) effective identification of the potential pool of prospective students, (2) personal rather than indirect contacts, (3) attractive financial aid packages, (4) provision of clear and adequate information about admission requirements, and (5) assistance in evaluating a minority applicant's academic qualifications and goals related to a program's goals and resources (Adams, 1988; Blackwell, 1981; Boone, Young, & Associates, 1984; National Board on Graduate Education, 1976). Graduate school efforts have been weakest in regard to helping minority applicants evaluate their qualifications. This weakness could be bolstered by preapplication counseling sessions, perhaps at meetings such as the GRE/CGS Forums, with students bringing transcripts and personal statements and graduate school officials providing information about the probability of acceptance at their institution and about the "fit" of student interests with the interests of graduate faculty.

These meetings could also allow potential graduate students to get information about additional courses that might strengthen their applications, summer internships with faculty and other similar programs that might lead to useful recommendations, and other graduate institutions that appear to be a better match with an individual's graduate goals and interests. It is important for undergraduate advisers or graduate schools to provide this help because minority students who may not be able to meet traditional admission criteria may, nevertheless have the ability to complete graduate degree programs successfully (Hartnett & Payton, 1977; Pruitt & Isaac, 1985).

Thomas and her colleagues (1992) report that the most prevalent strategies for minority recruitment were directed by the Office of the Graduate Dean and included (1) distribution of funds to departments for recruitment; (2) sponsorship of graduate conferences, fairs, and summer research activities for minority undergraduate prospects; and (3) participation in name exchange programs to identify promising minority candidates. In general, however, most informal recruitment relies on the effectiveness of professional networks of individual faculty members (Pearson, 1985; Pruitt & Isaac, 1985), although the establishment of relationships with historically Black or predominantly minority institutions is a formalization of this approach. The more assertive, direct, and personal approaches to recruiting -- such as networking, summer research programs, and the recruitment of an institution's own undergraduates -- appear to be more successful than passive strategies such as mailings, name exchanges, and the like (Thomas, et al., 1992).

Application/admission. After students decide to pursue graduate study, they must apply to particular schools. Unlike undergraduate admissions, where decision making is a centralized process, admission to graduate study is a more diffuse process, with decision making often decentralized to departments and/or divisions within departments (National Board on Graduate Education,

1976; Pruitt & Isaac, 1985; Thomas et al., 1992). Although there may well be general admission policies for a graduate school, these guidelines are often implemented in different ways by different schools and departments. Departmental criteria are usually more stringent than the general graduate school requirements (Thomas, et al., 1992). Departments and graduate councils appear reluctant to develop formal policies for special admission of minority students, but there are informal procedures that involve "conditional admits" or waivers of various requirements (Clewell, 1987; Oltman & Hartnett, 1984).

Information is scarce on the prevalence of "exceptions" policies and their effectiveness in admitting successful minority applicants. Thomas and others (1992) found that exceptions in their study were usually made when minority students had relatively low GRE scores but strong letters of recommendation and very high undergraduate GPAs. Hartnett and Payton (1977) evaluated programs with flexible policies for undergraduate GPA and GRE scores of minority students. They found that large numbers of Ford and Danforth doctoral fellows who went on to complete their degrees might not have been admitted to graduate school had admission committees employed traditional criteria in a strict manner. A recent study by Zwick (1991) of a small number of relatively selective institutions suggests that GRE scores and undergraduate GPA seem to be essentially unrelated to predicting graduate students' degree completion rates, although this may be due to restriction of range of the test scores.

Very little is known about special admission practices and procedures used by graduate departments in admitting minority applicants and about the effectiveness of these alternative criteria in selecting students who successfully complete a graduate degree. More research is needed that will document formal or informal admission practices that have been successful.

Clewell (1987) reviewed the literature on admission practices and policies from both an institutional and a student perspective. The information most commonly used by institutions to select graduate students were GRE scores, undergraduate GPA, letters of recommendation, biographical information (such as special accomplishments or experiences), and a statement of research interests. This last factor has rarely been considered in research on the admission process. It may be critical to a minority student's success in gaining admission and may also influence research and teaching fellowship opportunities as well as the quality of the mentoring experience the student subsequently receives. For example, Black and Hispanic students may select areas of concern primarily to minorities that are not considered central to the discipline and are of peripheral interest to faculty (Clewell, 1987; Gorse, 1987).

Financial aid. The amount and type of financial aid available to graduate students is an important factor influencing both entrance into and completion of graduate education. After the data were controlled for undergraduate GPA and other variables, students who receive financial aid were more likely to enroll in graduate school than accepted students who did not receive aid offers (Ekstrom, et al; 1991); they were also more likely to enroll in a doctoral rather than a master's degree program (Wilder & Baydar, 1990). Receipt of financial aid is also positively related to persistence in

graduate school and doctoral degree completion (Ekstrom, et al; 1991; Ethington & Smart, 1986; Thomas, et al; 1991; Trent & Copeland, 1987). Black humanities doctorates with strong sources of support for graduate study completed their degrees in much less time (often six years or less) than did students with little or no support (Brazziel & Brazziel, 1987).

Changes in financial assistance availability have coincided with changes in minority degree attainment rates (Nettles, 1987). Because of decline in government funding, colleges and universities have become more important as sources of fellowships, assistantships, and scholarships for graduate students. An important question is how to develop policies and practices to provide the types and amounts of financial assistance that encourage minority student enrollment and retention (Trent & Copeland, 1987).

Considerable differences exist among racial/ethnic groups in the type of financial assistance they receive. Approximately 40 percent of all Asian American doctoral degree recipients in 1988 received aid in the form of university support (fellowships, teaching/research assistantships, etc.), compared to 31 percent of Hispanics, 24 percent of Blacks, and 19 percent of American Indians (Thurgood & Weinman, 1989). Approximately 60 percent of Black and American Indian doctoral recipients in 1988 reported personal financial support (such as own earnings, spouse earnings, and family contributions) for their graduate education, but only about 36 percent of Asian American and 46 percent of Hispanic doctoral recipients reported this type of support.

Black students are less likely to apply for and receive teaching and research assistantships (Nettles, 1990; Thomas, et al; 1992; Wilder & Baydar, 1990). This pattern results, in part, from graduate departments restricting their nominations of minority graduate students to minority-targeted fellowships (Thomas, et al; 1992). The almost exclusive use of fellowships for minority students has, however, often meant these students have not received other forms of aid, such as research or teaching assistantships, that might assist their integration into a department and give them access to mentoring and apprenticeship opportunities (Adams, 1988; Chandler, 1988). More research is needed on the educational consequences of different financial support mechanisms and financial aid packages and on the impact of exemplary minority state financial aid programs (such as the McKnight Fellowship Program and the Pennsylvania State College American Indian Program) on recruitment, enrollment, and retention.

Slightly more than half (55 percent) of all U.S. citizens who received a Ph.D. in 1988 reported having educational debt; the average amount of this debt was $7,649 (Thurgood & Weinman, 1989). Both the proportion of Ph.D. recipients with debt and the median level of debt were highest among Hispanic students (66 percent, $8,283). Comparable figures for other racial/ethnic groups were: American Indians, 63 percent, $7,116; Asian Americans, 53 percent, $7,748; Blacks, 61 percent, $7,655; and Whites, 54 percent, $7,616. These differences may reflect major field variations. There was considerable variation by field in the percentage of indebted students and the amount of debt. Students in the social sciences were most likely to have debt (61 percent) and also had the highest median level of debt. Debt was least common

among students receiving Ph.D.s in engineering (34 percent) and education (38 percent). The amount of indebtedness was lowest among students in the physical sciences ($6,192).

Level of financial aid varies by academic field, with the highest amounts for students in the sciences and the lowest amounts for students in the social sciences. This difference, however, may reflect the fact that students in the sciences are most likely to be attending graduate school full-time (Wilder & Baydar, 1990).

Field of study. We need to know more about the reasons students from different minority groups tend to concentrate in different fields. Frank Leong, a professor at Ohio State University, has suggested that "Different racial and ethnic minority groups have come into this country and gone toward openings and gaps in society." He says that Asian American students have found that they are not challenged by local and previous established groups if they enter the sciences and that "entering the sciences has been safe for them" (as quoted in Backover, 1992). A somewhat different hypothesis has been posed by Quincy Moore, a professor at Virginia Commonwealth University, regarding the concentration of Black doctoral students in education: "Historically, when African Americans were allowed to be educated at all, a major concern has been the continuing education of our people....We naturally gravitated toward a field that would allow us to help other people coming through the system" (as quoted in Backover, 1992).

Moore goes on to say this interest in helping others has also led Blacks into the social sciences. The low number of Black doctorate recipients in science and the humanities, according to Moore, is a reflection of efforts to steer Black elementary and secondary school students away from so-called "harder" disciplines such as the sciences. Moore believes these efforts are the product of biases that may be held by teachers and counselors. As a result, Moore says, when Black students enter college they are often too far behind their classmates in subjects like the sciences to be able to major in them and go on to graduate education. Moore has argued that stronger multicultural training of elementary and secondary teachers and counselors is needed before the concentration of minorities in specific fields will improve.

The Impact of Test Scores on the Admission Process

The differences in performance of racial/ethnic groups on the GRE tests are well documented (Pennock-Roman, 1990; Smith, 1986; Wah & Robinson, 1990). On the verbal section, White and Asian American examinees substantially outperform Mexican American examinees, whose mean scores are higher than those of Puerto Rican and Black examinees. Scores on the quantitative section display a similar pattern, although Asian American examinees substantially outperform all other groups on this section.

Test score gaps between minority and non-minority GRE test takers have been a subject of recent Board-sponsored research. If one compares score differences among racial/ethnic groups on the GRE General Test and on the Scholastic Aptitude Test (SAT), a test used widely for undergraduate admissions, some differences appear to be larger on the GRE. Three possible

explanations have been posited: (1) academic equity may develop more slowly among minority test takers, (2) the two tests measure different traits, or (3) different people take these two tests. Recently, Pennock-Roman (1990) showed that, for a number of reasons, the SAT and GRE databases are not directly comparable, and comparisons of the two can be very misleading. However, when she analyzed score differences for groups of individuals who had taken both tests, Pennock-Roman found that generally the gap between White and minority test takers was closing, i.e., between-group differences were smaller on the GRE General Test than on the SAT.

There has been concern expressed (Mestre & Royer, 1991) that tests used to assess Hispanic students (and other students for whom English was not their first language) be sensitive to cultural and linguistic influences during the time the student is achieving second language proficiency and being acculturated but also not be systematically biased against students who have developed second language proficiency and achieved a degree of acculturation.

In 1984 the main emphasis of the MGEC Research Plan (Williams, 1984) was to examine the admission process and the impact of test scores and other traditional performance indicators on minority participation rates. The appropriateness of test score use in the admissions process and its effect on minority participation in graduate education revolves primarily around three issues: test bias, predictive validity, and differential validity. Two factors have limited research in this area in the past: Data on the racial identity of GRE test takers was not collected before 1974-75, and the numbers, especially by subgroup population, of minority first year graduate students are small.

Psychometric issues. We have chosen not to include in this framework technical studies designed to resolve psychometric issues related to minority access to graduate education. This omission in no way diminishes the importance of such research to our work. Rather, it reflects the fact that such analyses fall under the umbrella of other in-progress research activities. In the next section, we identify research questions in predictive validity and item bias detection that must be addressed by researchers examining psychometric concerns facing the GRE Board.

The GRE Board and its Research Committee are likely to continue their current policy of encouraging separate analyses by subgroup in all research studies where differential effects on performance are a possibility and where data availability permit. The MGE project is not intended to replace incorporation of minority concerns into all pertinent research projects. Rather, we hope to benefit from such incorporation and, where possible, help identify critical issues research must address.

Questions related to predictive validity. The GRE Board has adopted a separate research framework to guide and direct research related to predictive validity. Beyond the broad question of how much the GRE tests add to the prediction of graduate school success, several questions related specifically to minority graduate school applicants should be addressed:

- o Is the relationship between commonly used predictors (such as GRE test scores and undergraduate grade point average) and commonly accepted criteria for success (such as first-year average in graduate school) the same for minority and majority test takers?

- o Are there variables other than test scores and undergraduate grade point average that would serve as better predictors of graduate degree completion for minority graduate school applicants?

- o Do some interventions, such as coaching, affect the performance of minority test takers differently than the performance of majority ones? How do these differences affect the predictive validity of the test?

For this third question, some evidence has been gathered (Powers, 1987) suggesting that the effects of test preparation (at least for the original GRE analytical measure) may be quite uniform for various subgroups. The implication is that, when given the same relevant preexamination experience, various subgroups (including Black and White examinees) achieve comparable improvements, even when initial test scores differ dramatically.

In the past, the small number of minority students in most graduate departments made it nearly impossible to design and conduct studies of differential prediction for minority test takers. At the departmental level, there were rarely enough minority students for the Validity Study Service to conduct separate studies of GRE validity for them. However, the incorporation of empirical Bayes methods into the Validity Study Service may provide a mechanism to combine data about minority graduate students across departments and estimate differential prediction for these students. Studies employing empirical Bayes methods may be extremely valuable to the MGE project research. In addition, we need to have long-range studies of GRE validity, not simply validity in relationship to first-year grades in graduate school.

Test bias/item bias. GRE-sponsored research has investigated the possibility that a single test, or individual items within a test, might perform differently for different population subgroups. "Perform differently" can mean several things: measure different constructs, resulting in differential prediction; be differentially difficult; or have content that is offensive to a particular group of test takers. Recent ETS research on differential item functioning (DIF) focuses on identifying test items that show different statistical item characteristics between matched samples of minority and majority subgroups, regardless of whether there is any logical explanation for the performance differences.

The DIF analyses conducted routinely for the GRE General Test show that about 5 percent of verbal items are more difficult (or easy) for some groups of examinees. For the quantitative measure, this figure is about 4 percent; for the analytical measure, it is less than 1 percent. Overall, the General Test exhibits only a small number of items with differential difficulty.

Continuing investigation of differential item performance among minority subgroups should include attention to such questions as:

- o Do certain item types (such as analogies) consistently under-predict minority performance?

- o Do some item characteristics (such as embedded negatives) adversely affect minority performance?

- o Can content areas (like natural science passages measuring reading comprehension) that consistently under-predict minority performance be identified?

- o Do different modes of presentation of the same test item (such as paper-and-pencil or computer-administered) result in different results for minority subgroups?

Wild, McPeek, Koffler, Braun, and Cowell (1989) investigated the concurrent validity (the correlation with self-reported undergraduate grades) of several verbal item types used in the GRE General Test. The reading comprehension items were consistently slightly more valid than other item types across all groups, and the analogy item types contributed slightly less to concurrent validity of the verbal measure. Because, the differences were so small, however, and the findings were not completely consistent across groups, no specific changes to the test seemed warranted.

Recent studies have revealed the following:

- o Black examinees do not perform as well on questions about science passages as White examinees (Scheuneman & Gerritz, 1990).

- o Black examinees tend to perform relatively better than White examinees on more difficult verbal items and not as well on easier items. The amount of context provided in the items appears to moderate the relationship: The greater the degree of context, the lower the correlation between differential functioning and item difficulty (Freedle & Kostin, 1988).

Test use issues. Because of the decentralized nature of graduate admission decisions, it is difficult to determine how test scores are used. Institutional surveys of graduate institutions/departments (Burns, 1970; Oltman & Hartnett, 1984) found that a majority of graduate schools have some basic minimum requirements that apply across all departments. The dean's office quite often has a review function, but selection is usually the responsibility of the department. Surveys of institutions have often ranked undergraduate transcript and GPA as the most important criteria for selection, and students generally believe grades to be a critical factor. But Black and White candidates may differ in their perception of the importance of GRE test scores. Powers and Lehman (1983) found that Black candidates thought the test had greater significance to admission than White candidates did. These findings are important because of their implications for candidate behavior during the admission process.

We need to understand more about how GRE test scores are used, particularly for minority candidates, in admissions. Baird (1982) found that

when applicants were grouped by ethnicity, Black and Hispanic applicants reported somewhat lower acceptance rates than White applicants. When applicants were grouped by GRE score category, minority students in the two upper score categories reported slightly more frequent acceptances than White students. In the lowest category, Black and Hispanic students reported fewer acceptances. Because more Black and Hispanic students are in the lower score ranges than the upper ones, such findings raise questions about institutional selection practices.

There is also concern about increasing use of test scores as cutoff standards for graduate admissions and how this practice might have contributed to the declining enrollments of Black students (American Council on Education, 1985). While the recent imposition of more rigorous standards for test score use is apparent, research indicates that many institutions have had policies for waiving requirements for certain individuals under certain conditions. Oltman and Hartnett (1983) reported that 12 percent of the respondent institutions in their survey had policies allowing differences in the weighting of various admission criteria for minority applicants. This finding was supported by Hamilton (1973) as well as by recent research by Thomas and others (1992) documenting flexible admission practices for minority applicants in most of the departments studied.

A related issue concerns Asian American graduate school applicants. The representation of Asian Americans in higher education has grown considerably in the last decade. Despite the fact that Asian Americans are over-represented in many fields in proportion to their numbers in the general population, there is growing concern that these students are being discriminated against in admission practices and that quotas are limiting the acceptance rate of highly qualified Asian American students. Although this charge has largely been leveled at undergraduate institutions, more research is needed on this issue at the graduate level.

Changes in the GRE. The GRE General Test is currently being changed from a paper-and-pencil test to a computer-administered test. While the 1993 computer-administered General Test is a linear test, very similar to the paper-and-pencil test, a computer-adaptive GRE General Test is being introduced in FY 94 (Kuh and Mills, 1993). New types of measures are being considered for the new GRE, and research studies of these measures are being planned. Equity concerns will, of course, be a part of this research. ETS wants to be sure that the computer-administered test does not present any special problems for minority populations by posing questions such as "Can a computer-administered test be equally fair to individuals who have little or no knowledge of or experience with computers as well as individuals with considerable computer sophistication?" It is also important to determine if the new GRE will have appropriate validity for minorities and other special populations (older students, people with disabilities, etc.).

The development of a new GRE General Test provides an excellent opportunity to create measures of different talents than those on which the paper-and-pencil test were based. In particular, this provides an opportunity to identify talents that help minority students succeed in graduate education but that were not assessed in the past. One area of research for the new GRE

General Test has to do with student choice. When given several questions/topics from which to choose, do minority students make similar or different choices from majority students? Do they tend to choose more difficult questions? What kinds of information about the student are provided by the questions selected, especially information about non-cognitive characteristics such as willingness to tackle difficult problems? The GRE Program may also consider investigating self-adaptive testing, where the student rather than the computer decides if the next test item is to be easier or more difficult. This, too, may provide additional information about the non-cognitive characteristics of the test taker.

Development of computer-administered tests has sometimes involved changes in test taking time, ranging from having no time limits to imposing time limits for each test item. However, this is not the case for the GRE. The current computer-administered GRE General Test uses time limits for each section, similar to those on the paper-and-pencil test. Previous research (Wild, Durso & Rubin, 1982) found that increasing time limits on the verbal and quantitative sections of the GRE did not improve the scores of minority test takers.

Retention and Completion

Minority students enter graduate education at a lower rate than do White students, and once admitted their attrition rate is greater. Astin (1982) estimated the dropout rate at 41 percent for White students, 45 percent for Black students, and 52 percent for Mexican American and Puerto Rican students. More recently, Oliver and Brown (1988) and Sowell (1989) reported that attrition rates for Black and Hispanic graduate students at major universities are as high as 60-70 percent.

Although the data on doctoral attrition are scarce, available evidence suggests that the attrition rate has increased for all students in recent years and that the drop in completion rates is associated with deteriorating job prospects in academe (Bowen & Rudenstine, 1992). Using data from six fields at 10 universities, these authors estimate that approximately 87 percent of all students who enter graduate education will return for a second year, that approximately 80 percent of those who return for a second year will achieve ABD (all but dissertation) status, and that approximately 81 percent of students who achieve ABD status will go on to obtain a Ph.D. The cumulative results of these data mean that approximately 56 percent of the students who enter graduate education eventually obtain a Ph.D.

Time to degree. A related concern is the amount of time students take to complete a doctorate. Tuckman, Coyle, and Bae (1990), using data from the National Research Council, found that by 1986, average time to degree had risen to 10.5 years from about 8.5 years in 1958. This increase may be linked to lower retention of graduate students, especially minority and other low socioeconomic status students who may be under pressure to start earning as quickly as possible. Longer amounts of time are required to complete degrees in the humanities and in education than to complete degrees in the physical sciences and engineering, but Tuckman and his colleagues found increases in each of the 11 fields they studied. For an alternative view, which attributes

the increased time to degree as "mainly a statistical artifact," see Bowen and Rudenstine (1992).

Baird (1990) found that departmental emphasis on scholarly careers and departmental resources to implement this emphasis were related to time to degree. Commenting on the difference in time to degree in the sciences and the humanities, Baird suggests this represents differences between "problem-solving disciplines" and "problem-finding disciplines," with the greater "diversity and reliance on interpretation and problem finding" required in the humanities resulting in a need for more time to master the field. Differences in field choice may account for some of the observed differences in time to degree between minority and non-minority students.

In examining time to the doctorate for older students (those who completed their bachelor's degree at age 25 or older), Brazziel (1992) found field of study, parental education, attendance at a junior or community college, and primary source of support for doctoral study to be the major predictors across fields. Within the fields of education, humanities, the social sciences and the life sciences, attendance at a junior or community college and primary source of support were important predictors.

Several studies have found source of support to be a strong predictor of time to degree, whether using national data sets or examining institutional data (Abedi & Benkin, 1987; Bowen & Rudenstine, 1992; Brazziel, 1984; Brazziel, 1992). Graduate students who must rely on their own financial resources require a longer time to obtain a doctorate. Gillingham, Seneca, and Taussig (1991) developed and tested an economic model of time to degree and found that field of study, amount borrowed, household income, and hours spent studying had a direct effect on expected time to degree; hours spent studying and amount of fellowship, scholarship, or grant had an indirect effect. Unfortunately, none of these studies included the effects of minority group membership on time to degree completion. Teaching assistantships, which facilitate academic involvement but may require considerable time for course preparations, can lengthen time to degree (Bowen & Rudenstine, 1992).

Models of graduate school retention/completion. Both institutional and individual factors affect minority retention and completion at the graduate level. Tinto (1991) is working to modify his model of attrition from undergraduate education to the graduate level. He believes that graduate school attrition is more strongly related than undergraduate attrition to departmental characteristics and specific relationships within a department. Because doctoral persistence reflects the normative and structural character of a field, there may be significant differences between fields of study. Tinto posits three stages of doctoral persistence, with different factors influencing each stage: 1) transition and adjustment, typically involving the first year of study, with students determining if they wish to become members of the academic community and evaluating the costs and benefits of involvement; 2) attainment of candidacy, with students developing professional competencies, culminating in doctoral examinations; and 3) completion of the dissertation, which involves both student abilities (cognitive and conative) as well as relationships with mentors and advisers.

We need to know more about the differences between students who enter graduate education seeking the doctorate and those who enter for a master's degree. O'Brian's report (1992b) is the best current summary of information on master's degree students. A more detailed study is A Silent Success: Master's Education in the United States (Conrad, Haworth & Millar, 1993). This work concluded that high quality master's degree programs are characterized by: 1) a common culture, based on unity of purpose among program participants and a supportive learning environment; 2) planned learning experiences that include core course work, immersion, "doing-centered learning" (such as laboratories, field work, internships, and practica), individualization, requirement of a tangible product (such as a thesis or project report), and out-of-class activities; 3) resources, including both institutional and departmental support; and 4) the human dimension, including faculty involvement, faculty with relevant workplace experience, committed students with diverse backgrounds and experiences, and strong program leadership.

Girves and Wemmerus (1988) have developed and tested two models of progress toward graduate degrees, one for master's programs and one for doctorates. The percentage of minority students in a department (which averaged about 7 percent) was unrelated to degree progress at both the master's and doctoral levels. Undergraduate grades were the best predictor of degree progress in master's degree programs. Full-time enrollment, enrollment in a department with an applied (as opposed to basic) research focus, and enrollment in a large department were also significantly associated with master's degree progress. The perception of the quality of the faculty adviser and the concern and usefulness of the adviser were also related to progress in master's degree programs. Neither academic involvement nor satisfaction with or alienation from a program were significant in predicting progress toward a master's degree. In doctoral programs, student academic involvement was the best predictor of progress. Being treated as a colleague was also very important. Other variables significantly associated with progress in doctoral programs included full-time enrollment and enrollment in a program concerned with living (as opposed to inanimate) objects of study. Academic involvement at the doctoral level was associated with financial support (having an assistantship or fellowship) and student perceptions of their relationship to faculty (feeling that one is seen as a colleague).

Andrieu and St. John (1993) have explored the relationship between the cost of graduate education and persistence in graduate school. They found that graduate students in public colleges were sensitive to tuition charges, with persistence reducing about .23 percentage points for each $100 in tuition. Prices did not appear to be as much of a problem for graduate students in private colleges. There was an association between expected earnings and persistence in public universities. In public colleges, the amount of graduate assistantship awarded was negatively associated with persistence; the authors concluded that the use of graduate assistantships to finance graduate studies could be problematic for students in graduate programs with limited earning potential.

Minority students may adjust to the demands of graduate and professional education somewhat more slowly than White students. Powers (1984) found that

in 18 of 21 law schools, Black students showed greater improvement than White students when third-year grades were compared with first-year ones. Chicano students showed greater improvement in six of nine schools.

Two studies of graduate school success of Black students, using grades as the criterion, have found that undergraduate grades are one of the best predictors (Braddock & Trent, 1991; Matthews & Jackson, 1991). Other significant criteria were educational aspirations (Braddock & Trent, 1991) and, for males age and the percentage of Blacks enrolled at the undergraduate institution to be significant predictors of GPA for Black male graduate students (Matthews & Jackson), with the smaller the number of Black students at the undergraduate institution being associated with higher graduate GPA.

In her review of the literature on retention, Clewell (1987) found four factors to be strongly associated with graduate school success: academic integration, relationships with faculty, institutional climate/peer relationships, and financial aid. These factors are discussed below.

Academic integration. Academic integration -- the degree to which students feel a part of the department and participate in the professional activities of their chosen field -- appears to be a critical factor for success in doctoral programs (Arce & Manning, 1984; Girves & Wemmerus, 1988). Unfortunately the literature reveals that minority students tended to participate less often than their White peers in activities that could facilitate academic integration -- attending conferences, co-authoring papers with faculty, etc. A number of minority student surveys have found that they experienced feelings of loneliness and alienation at their institutions and in their departments (Allen, Haddad, & Kirkland, 1984; Carrington & Sedlacek, 1976; Clewell, 1987; Duncan, 1976; Green & McNamara, 1978). However, Nettles (1990) found that Black students were significantly more satisfied with their doctoral programs than either White or Hispanic students, and Hispanic students expressed more satisfaction than their White counterparts. The issue of academic integration, especially at the departmental level, is further complicated by the nature of various academic disciplines, some of which encourage integration more than others.

Padilla and his colleagues have been exploring the role of heuristic knowledge in academic integration and becoming a successful student (Murgía, Padilla, & Pavel, 1988; Padilla, 1991; Padilla & Pavel, 1988). This work has shown that minority (Hispanic and American Indian) students integrate into the academic and social environments on their campuses by using heuristic knowledge acquired from other minority students from similar racial/ethnic backgrounds and from minority academic advisors.

Faculty relationships. Relationships with faculty, which are important to students' academic integration, are associated significantly with outcome in attaining the doctorate (Cohen, et al., 1980; Girves & Wemmerus, 1988). However, Braddock and Trent (1991) found no unique effect for contact with faculty on the grades of Black graduate students. Minority students' interaction with faculty, particularly White faculty, is complicated by a host of problems, and Black students tend to feel more remote from faculty and have more negative interactions with faculty than do White students (Baird, 1973;

Duncan, 1976; Hall & Allen, 1982). Thomas and her colleagues (1992) found minority students were less likely to interact with faculty than White students. This study also found faculty/student interaction to be the most important predictor of students' satisfaction with their graduate experience. Having a faculty member as a mentor is particularly important to success in graduate school, but research indicates that Black students are less likely to have access to mentoring experiences and more likely to be advised by individuals whom Blackwell (1983) refers to as "sponsors, advisors, teachers or peers." However, recent research (Nettles, 1990; Thomas, Clewell, & Pearson, 1992) indicates that minority students report no significant differences from Whites in having a mentor.

Gender and race/ethnicity may interact to create special problems for minority women. A recent study (Turner & Thompson, 1993) found that minority women in graduate school reported gender discrimination as more important than racial discrimination; they received socialization experiences that enhance their academic progress more often than did majority women. Although gender is perceived as a barrier for majority women as well, minority women face additional obstacles to success in graduate education and academic employment (Turner & Thompson, 1993).

Williamson and Fenske (1993) have conducted one of the few studies that provides detailed information about Mexican American and American Indian doctoral students. Using the Nettles (1990) Doctoral Students Survey of Programs and Experiences, they collected information from 214 students attending six research universities in the southwest in 1989-90. They concluded that Mexican American and American Indian doctoral students were inadequately socialized into their departments. Many of these students believed that White/Anglo faculty on their campuses had lower expectations for them than for White/Anglo doctoral students. A lack of mentors and a lack of faculty concern contributed to these students' sense of isolation, but interactions with faculty and others in a department counteracted perceptions of inhospitality. Additional analysis of this data showed that students of Mexican American and American Indian background had similar perceptions of academic achievement but, within each group, there were significant differences by gender. Although the women excelled academically in comparison to the males, they perceived themselves as less outstanding and as receiving less recognition for their achievement than their male counterparts. This analysis also showed that although these students viewed their advisers as knowledgeable, helpful, and interested in their welfare, they clearly preferred an adviser/mentor of similar ethnicity and gender.

One research issue of importance here is the role of minority faculty in facilitating social and academic integration for minority students. While the literature contains many references to the importance of role models and the advantages of minority faculty supporting minority students, (Blackwell, 1981; Carrington & Sedlacek, 1976; Pruitt & Isaac, 1985), little research has separated the issue of minority status of advisers from that of the presence or absence of a mentor. The absence of minority faculty is a critical problem for the academy. The number of minority faculty at predominantly White institutions is distressingly low (Blackwell, 1981; Brown, 1988; Pruitt & Isaac, 1985). Burdening that faculty with university matters where a minority

perspective is desired or where minority concerns are central may threaten to overwhelm minority professors and leave them little time for scholarship and other activities necessary to the academic advancement and achievement of tenure. More attention should be paid to nurturing minority faculty and developing their role in mentoring students. Studies of Hispanic and Black faculty (Gorse, 1987; Silver, Dennis, & Spikes, 1988), focusing on their faculty characteristics, attitudes, and perceptions of their positions in academe, present a starting point for this type of research. Because the number of minority faculty at predominantly White institutions remains low and is not expected to increase dramatically in the near future, it might be relevant to conduct research on attitudes and practices of White faculty related to minority student retention.

Institutional climate/peer relationships. The climate of a graduate school -- its receptiveness to cultural pluralism and its efforts at integrating minority students into the social and intellectual life of the graduate community -- are essential elements in programs that admit and retain significant numbers of minority students.

The racial climate of an institution or a department is closely related to minority graduate student retention (McBay, 1986; Pruitt & Isaac, 1985; Robertson, 1980). In several surveys of graduate students, Black and Hispanic students have been much more likely than Whites to state that racism exists in their departments or institutions (Duncan, 1976; Green & McNamara, 1978; McBay, 1986; Nettles, 1990). Thomas and her colleagues (1992), in interviewing faculty and students, found respondents agreed almost unanimously that racism existed at both the institutional and departmental levels and tended to be subtle rather than overt. In the same study, a much greater percentage of Black and Hispanic graduate student respondents admitted to having personally encountered racism than did White respondents (51 percent and 33 percent of Black and Hispanic students, respectively, versus 9 percent of White students).

Financial aid. As mentioned earlier, receipt of financial aid is found to be positively related to persistence in graduate school and doctoral degree completion (Andrieu & St. John, 1992; Ekstrom, et al; 1991; Ethington & Smart, 1986; Thomas, et al; 1992; Trent & Copeland, 1987). The kind of financial support a student has in graduate school has been identified as the single most important predictor of time to the doctorate (Abedi & Benkin, 1987). Doctoral students who supported themselves took more time to complete a degree. The authors suggest that if graduate students are adequately supported by their universities and do not have to work off campus, the speed with which they complete degrees will improve.

Black and Hispanic students are considerably more likely to finance their education with loans, grants, and fellowships than their White classmates; Black students are less likely to hold teaching and research assistantships (Blackwell, 1981; Copeland, 1984; Council of Graduate Schools, 1984; Nettles, 1990; Nettles, et al., 1986; Thomas, et al., 1991). These experiences are important apprenticeship activities. Not only do they allow for fuller integration into the academic life of a department, they also frequently lead to publications and work experiences that are beneficial when

seeking jobs after graduation (Clewell, 1987; Girves & Wemmerus, 1988). The Thomas, Clewell, and Pearson study (1992) found that having a research assistantship was one of the most significant predictors of greater faculty-student interaction, an important factor in achieving academic integration.

More research is needed on the most effective packaging of financial aid as well as the best distribution of different types of aid over the stages of doctoral education. Research has suggested, for example, that minority persistence is encouraged by a financial aid plan providing fellowship support for the first year of graduate school, research and teaching assistantships thereafter up to the dissertation stage, and then fellowship support through completion (Jacks, et al., 1983; Thomas, et al., 1992).

Research is also needed on the effectiveness of national fellowship programs and fellowship programs offered by professional associations, especially components of these programs targeted at minority graduate students. Bowen and Rudenstine (1992) report mixed results in the ability of national fellowship programs to increase completion rates or to reduce time to degree. They suggest that the most important role of such programs may be attracting students to graduate education. However, Bowen and Rudenstine did not specifically examine the effect of fellowship programs on minority graduate student retention.

Effective retention programs. Effective retention efforts are characterized by an institution-wide policy initiated, directed, and coordinated at the highest level of administration; leadership from the graduate dean as well as departmental commitment and involvement; provision of support services focusing on areas that require special attention; and an efficient record-keeping system to monitor effectiveness (Clewell, 1987; Hamilton, 1973; Olson, 1988). Retention programs should include the provision of financial aid and, support programs to provide academic and personal counseling, tutorial and academic support, and social activities (Clewell, 1987; Hamilton, 1973; National Board on Graduate Education, 1976). Bowen and Rudenstine (1992) state that, to achieve better completion rates and lower time to degree, our understanding of the dynamics of graduate programs and the role of faculty in defining for students what is and is not important in a given department must improve.

The Council of Graduate Schools has reached similar conclusions about effective retention activities. They recommend: 1) regular follow-up activities to maintain contact with and monitor the progress of enrolled students; 2) financial support strategies directed at retention; 3) academic support and mentoring programs for minority students; and 4) creation of a supportive environment (Council of Graduate Schools, 1992c).

III. WHAT RESEARCH SHOULD BE UNDERTAKEN NOW?

The 1990 GRE conference on minorities in graduate education produced three papers on directions for future research (Blackwell, 1992; Pruitt, 1992; Duran, 1992) and a summary of these by Trent (1992). As Trent noted, the conference was organized around core topics including the pipeline, financial aid, attainment, recruitment, and retention; presentations examined the barriers to Black, American Indian, and Latino access to and success in graduate education. The research recommendations by Blackwell (1992), Pruitt (1992), and Duran (1992) all fit within this conceptual framework. Trent suggested adding an additional topic -- institutional practices.

The conference participants agreed on the need for more qualitative research, especially the importance of learning more about small subpopulations, and the importance of data disaggregation. The participants also emphasized the need to learn more about institutional policies and practices and about student and faculty attitudes and behaviors.

Conference participants recommended future research on the following:

- The impact of student motivation, attitudes, family circumstances, resources, and other factors on minority student participation in graduate education.

- The routes that minority students take to and through graduate school.

- The career paths of minorities who obtain doctorates, including the experiences of minority faculty.

- How minority students plan for the cost of graduate education and learn about the availability of financial aid.

- The educational consequences of different financial aid mechanisms on minority student recruitment, enrollment, and persistence in graduate school.

- The impact of financial aid initiatives, such as the McKnight Fellowship Program, on minority graduate student recruitment, enrollment, and retention.

- The impact of tests and various test use practices on minority applicants and alternative measures of academic talent that might be used for admission into graduate programs.

- The role of faculty in the recruitment of minority students and the relationship of faculty mentoring to the retention of minority students.

- The impact of institutional climate (especially racism) on minority students' path to doctorates.

o How institutions communicate their commitment to increase minority enrollments and to serve diverse student populations.

Both the MGEC conference proceedings and the research reviewed in this agenda make clear the importance of continuing the MGE research program. Although this program has provided valuable information on a number of topics, important issues related to minority graduate education still need investigation.

Supply of students. One of the most urgent areas of research involves learning about factors that limit the supply of minority students who have completed college and are potential clients for graduate education. We have much more descriptive work on demographic trends than we have analysis of factors that might explain those trends. We also need to investigate the reasons for the decline in high school completion and college participation rates among Black students in the early 1980s and why these rates increased in the late 1980s.

Students from different racial/ethnic backgrounds leave the educational pipeline at different points. We need research to help us understand why the greatest loss of Hispanic students occurs during the high school years while the greatest loss of Black students occurs after entrance into college. Because the points of loss and reasons for loss differ, these studies must address talent loss separately for each racial/ethnic group and within groups by gender. Where possible, pipeline studies should disaggregate data for American Indian, Asian American, and Hispanic subpopulations.

We need information on the pathways minority students take to and through graduate school to identify points at which large numbers of students may be lost. Are minorities who obtain doctorates more likely than White students to have begun their post-secondary education in a junior or community college, interrupted their post-secondary education at some point, finished a master's degree before enrolling for a doctorate, and/or attended a master's only institution?

A particular concern is the group of older students, especially those who start their post-secondary education in a junior or community college. Minority students are a large part of this older student population. We need to know more about obstacles that may prevent these students from continuing on into graduate education and about the ways that age and minority status may interact to present special problems.

We know little about how well various models of college persistence explain undergraduate attrition for minority students. In examining the undergraduate experience, we need to know more about how minority students cope with peer pressures that may limit achievement and with the stresses resulting from being a minority in a predominantly White educational system. We also need to study how these stresses affect educational progress and attainment. Many minority students have close ties to their families; we need to know how these ties affect continuation and success in college. A completely unexplored topic is the extent to which minority students perceive

conflicts between their own culture and traditions and those they encounter in the educational system. How do minority students handle such conflicts?

Admission issues. Although understanding factors that limit the supply of minority graduate students is important, we must investigate how minority students develop aspirations for graduate education and their perceptions of obstacles, especially those in the admission process, that may keep them from applying to or enrolling in graduate education. A second priority should be to conduct research on factors affecting the enrollment of minority college seniors or college graduates in graduate education. These studies need to examine admission issues both from a student perspective and an institutional one.

Little research has been done to learn how graduate schools and departments make admission decisions on underrepresented minorities, particularly whether they use differential weights for test scores and place different emphases on other performance indicators. It would be useful to understand the amount of emphasis departments give to various application components -- test scores, undergraduate grades, letters of recommendation, descriptions of undergraduate experiences and accomplishments, and information about students' research interests. We need to know if information use varies across departments and in different areas of graduate education. Are graduate departments, especially those with no minority faculty members, less likely to enroll minority graduate students than those with minority faculty? Are graduate departments less likely to enroll students whose research focuses on minority issues? We found no systematic studies of "special admits" procedures. How prevalent are they? How do they work? How effective are they?

It would be useful to learn what admission criteria are the best predictors of completion of graduate work, either with a master's degree or with a doctorate, and how these predictors vary by discipline (humanities, social sciences, physical sciences, etc.).

While there is considerable knowledge about the predictive validity of preadmission measures for students in general, more work is needed on test bias issues and predictive validity for diverse racial/ethnic groups. We need to know more about the relationship between test scores and the GRE Biographical Questionnaire information as well as the relationship between Biographical Questionnaire data and graduate school grades, retention, and completion. In addition, we need to investigate whether there are other student characteristics, not currently assessed in the GRE Program, that would better predict graduate school success. One area for such research would be non-cognitive or conate constructs, such as motivation, learning styles, self-concept, self-regulatory behaviors, and ability to handle academic or social stress as well as the stress related to being a minority student in a predominantly White graduate department.

There has been little research examining the minority student perspective. Studies from this perspective, following approaches suggested in the work of Tierney, Padilla, and others, are needed at both the undergraduate and graduate school levels. It is especially important to look at the

barriers they feel are present that may make it difficult for them to be successful students. As Braddock (1992) pointed out at the 1990 Minorities in Graduate Education conference, we need to know more about minority students' knowledge and perceptions of graduate education. We need to know how their aspirations for graduate education develop and how they are related to undergraduate experiences. We found few studies of minority students' knowledge about the graduate admission process or strategies for applying to graduate school. Nettles' work (1987) suggests it would be valuable to look at minority students' perceptions of the opportunity costs associated with graduate school attendance. If we are going to increase minority graduate enrollments, we must learn more about how and why minority students decide to attend graduate school and how they decide when to enter graduate education.

Financial issues. Financial considerations may affect minority students' decision to apply to graduate school as well as their persistence in graduate education after enrollment. As a result of the GRE minority graduate education and financial aid research studies, we now know considerably more about how indebtedness influences minority students' decisions to enroll and/or continue graduate education and about the roles different types of financial aid play in minority graduate student enrollment and retention.

We still do not know, however, how minority students view the opportunity costs and the actual costs of graduate education. We also need to conduct research on the educational consequences of different financial support mechanisms (contrasting fellowships, teaching assistantships, and research assistantships); innovative financial aid packages; and exemplary federal, state, and professional association minority fellowship programs.

Another important area for research is the way in which different types of financial aid relate to the academic integration of graduate students into a department and time to degree. For example, does having a research assistantship enhance the relationship between minority students and faculty members, both nonminority and minority? Does having a teaching assistantship reduce the time minority students have available for study and increase the time for them to obtain a degree?

Departmental and institutional environment, values, and practices. Given the small numbers of minority students currently entering graduate education, it is crucial that we learn more about how to ensure that these students complete their graduate degrees. Departmental and institutional structures and climates play an important role in minority success in graduate school. Academic integration and interaction with faculty appear to be especially important for minority graduate students. Tierney (1990) has provided an excellent summary of approaches to the assessment of academic climates and cultures.

It is important to explore institutional and departmental values as they affect minority students. Do faculty perceptions of minority students, especially older minority students, affect faculty expectations, faculty-student interactions, and the kinds of opportunities offered to minority students?

Research is needed on the processes involved in the academic integration and mentoring of minority graduate students. Studies should be conducted on conditions or strategies that increase faculty interaction with minority students and improve racial climates in the graduate setting. We especially need research on how minority and non-minority faculty affect academic integration and department racial climate, as well as studies of White faculty attitudes and perceptions about minority students. We need to learn more about the impact of departmental/disciplinary differences within institutions on the academic integration of minority students.

Ethnographic studies of minority experiences in graduate education are needed to supplement what is derived from questionnaire studies and analyses of data sets. Close observations without preconceptions can provide important insights and help to guide practice. In particular, we need to find out if minority students, at both the undergraduate and graduate education levels, experience conflicts between their heritage and traditions and the demands of higher education. This type of study probably would best be done using small focus groups, separating males and females within each racial/ethnic group. We also need to explore the ways in which the racial/ethnic diversity of graduate departments and the inclusion of multicultural topics, both in the classroom and in faculty research, are related to the academic integration of minority students.

Finally, we need to learn more about how the graduate school experience differs by both race/ethnicity and gender, and about how the effects of race and gender interact. Evidence (e.g., Muñoz, 1986; Chacón, Cohen, & Strover, 1986; Williamson & Fenske, 1993) suggests that the undergraduate and graduate school stresses and experiences of Mexican American females and males differ considerably. A careful study of groups of Hispanic men and women (Mexican American, Puerto Rican, etc.) in the sciences and social sciences would be especially useful. In addition, it may be useful to examine how the experience of racial/ethnic minority graduate students differs from that of White low-income graduate students and/or White graduate students whose parents did not attend college.

Retention and degree attainment. We need longitudinal studies on minority student progression and persistence to supplement and augment the findings of cross-sectional studies. It is important to determine if various criteria of graduate school success (such as first-year GPA, cumulative GPA, performance on qualifying or comprehensive examinations, faculty ratings, retention, and completion of the degree program) differ in their usefulness in studies of minority and non-minority graduate students.

It is also important to explore the usefulness of a wide variety of variables in predicting graduate school success. In particular, the role of non-cognitive characteristics (especially the motivational and volitional aspects of behavior that are becoming known as "conative constructs" (Snow & Jackson, 1992) and heuristic knowledge.

Research Methodology

Previous MGE research has utilized both quantitative and qualitative approaches. It is important for this multifaceted pattern of investigation to continue. Each methodology has its own strengths and limitations. Together they provide a more complete and comprehensive picture than can either alone.

Quantitative approaches. Research on graduate education has been limited because of data deficiencies. "No serious and regular effort is made to follow college seniors once they complete their undergraduate education to assess their postbaccalaureate choices and whether those who enroll are able to complete their advanced degree program" (Hauptman, 1986). Hauptman has complained that, except for the National Research Council Survey of Doctorate Recipients, data collection efforts are not systematic and information is not provided in a timely manner, thus restricting users' ability to draw policy inferences. He complained especially, about the weakness of data on how students finance their graduate and professional education. We need to investigate the potential of various data sources for informing MGE research needs to supplement analysis of demographic data sets and of data from GRE test takers.

Some MGE and GRE research in the past has used federal data sets such as the National Longitudinal Study (NLS) or High School and Beyond (HS&B). Although over-sampling of minority students was implemented in HS&B, the relatively small number of minority students going on to graduate education still limits the usefulness of these data. A parallel data set, the National Educational Longitudinal Study of 1988 (NELS:88) has been following a national sample of students who were enrolled in eighth grade in 1988. These students will reach college age in 1994; the 1994 and 1996 NELS follow-ups should provide information about choice and access to postsecondary education.

The federal government is implementing a longitudinal survey of graduating college seniors, to be called Baccalaureate and Beyond (B&B). This survey will follow a sample of graduating seniors from the National Postsecondary Student Aid Study (NPSAS). NPSAS is a comprehensive study of how students and their families pay for all forms of postsecondary education, including graduate and professional education. It will include both students who receive financial aid and those who do not. Previous NPSAS surveys took place in 1986-87 and in 1989-90. The NPSAS data sets are, in themselves, a useful source for studying graduate education. The 1987 sample included approximately 6,500 graduate students.

Another federal data source that should be investigated for its usefulness in understanding talent flow for graduate education is the Beginning Postsecondary Student Longitudinal Study (BPS). This study will follow NPSAS beginning students at two-year intervals. BPS data collection began in spring 1992 with students in the NPSAS sample who entered postsecondary education in the 1989-90 academic year; release of these data is scheduled for 1993.

Analysis of the B&B and the BPS data sets should provide information on topics such as the development of aspirations for graduate or professional

education, timing of application to graduate school, the application process, enrollment in a graduate program, and factors associated with persistence in and completion of graduate education. It will be important to determine if these data sets have sufficient over-sampling of minority populations to provide adequate numbers for analysis of different groups and sub-groups. It will also be important to determine the extent to which the data set variables cover topics that are necessary for understanding the situation of minority students in higher education.

Data from the National Study of Black College Students (NSBCS) are a valuable source for studying the undergraduate, graduate, and professional school experiences of Black students in 16 public universities. This data source has been used in numerous publications by Walter Allen and his colleagues.

The Association of American Universities (AAU)/ Association of Graduate Schools (AGS) Project for Research on Doctoral Education is another potentially useful source. The project currently is collecting information about doctoral program applicants and doctoral students in 10 fields in approximately 42 universities. This data base will be useful in answering questions about attrition/retention, progression to candidacy, and time to degree in different fields and about the effects of various types of financial aid on completion and time to degree. This data base has the potential of being used to explore these questions by age, gender, and race/ethnicity. However, because the number of minority students currently enrolled in doctoral education is fairly small, there is a concern about having adequate numbers of students from some populations and subpopulations.

Other graduate and professional school testing programs (such as the Law School Admission Test program) collect information from test takers; sharing this information should help us better understand how students choose among different graduate and professional school options.

Some foundations and many professional organizations have fellowship programs, some specifically for minority students (like the American Psychological Association's minority fellowship program). They maintain contact with these individuals throughout graduate school and sometimes into their careers. Although the students awarded such fellowships are atypical in that they represent the brightest and best entrants into graduate education, the nature of their graduate education experiences and the relationship of these experiences to completion of a doctorate should be highly informative. Foundations and professional organizations may welcome cooperative projects with GRE that provide ongoing monitoring of progress among the students they are supporting. Monitoring progress while the students are enrolled, rather than attempting follow-up studies is recommended since, as the Arce and Manning (1984) study of the Ford Foundation minority fellowship program found, it is very difficult to evaluate a program after the fact. Data collection and evaluation needs to be ongoing.

It may also be useful to explore the possibility of studies using existing institutional data sets or reanalyzing data that have already been collected, such as the Williamson and Fenske (1993) data on Mexican American

and American Indian doctoral students, which has collected both quantitative and qualitative data.

Qualitative approaches. In many cases large scale data sets are not appropriate for investigating questions about the talent flow of minorities into graduate education. The number of minority students may be insufficient, especially if over-sampling was not part of the design. The questions asked may also not be appropriate for examining issues that affect minority talent flow. For these and other reasons, MGE must continue a strong program of qualitative research. As participants at the 1990 Minorities in Graduate Education conference concluded, there is a "need for more qualitative research to learn more about groups with small numbers, such as American Indians and Hispanic subpopulations, and to obtain better information on institutional policies and practices and student and faculty attitudes and behaviors."

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