

MINORITY WOMEN IN THE ENGINEERING FRESHMAN CLASS: (1990-91 to 1995-96)

By Sangeetha Purushothaman, Ph.D

Research Associate

National Action Council for Minorities in Engineering, Inc., New York, NY.

INTRODUCTION

Minority women are the most underrepresented group of students in the nation's engineering institutions. They currently constitute only 4.6 percent of the engineering freshman class and comprised an even smaller proportion (2.5 percent) of engineering graduates in 1994-95. Past and ongoing NACME research has focussed on minority women graduates¹. This paper explores the enrollment patterns of minority women to determine whether there is a relationship between the institutions they choose and those that minority men select, in which to study engineering, or whether the distribution of minority women more closely resembles that of nonminority women in the freshman engineering class. To understand these relationships, we examined and compared the distribution of minority women, minority men, nonminority men and nonminority women in the freshman class by type of institution, cost and selectivity.

Our findings indicate a strong relationship between the selection of institutions made by minority men and minority women in the engineering freshman class. In other words, factors relating to race and ethnicity seem to be far more significant in determining the distribution of minority women in the freshman class than factors relating to gender.

METHODOLOGY

This research was conducted using enrollment data for minority women in the freshman engineering classes from 1990-91 through 1995-96, because data by gender and ethnicity was not available prior to 1990, when the Engineering Workforce Commission began to collect it under a grant from NACME. We explored the distribution of minority women in engineering colleges and universities relative to that of minority men, nonminority men and nonminority women, over the last six years looking at the following variables: type of institution (Historically Black Colleges and Universities, Hispanic Association of Colleges and Universities, public, private and research institutions), college cost and selectivity.

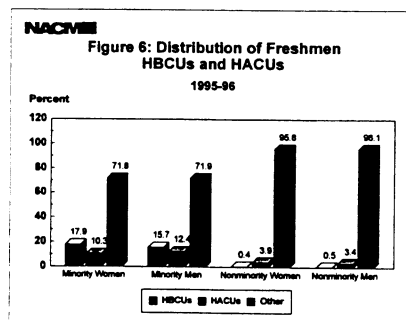
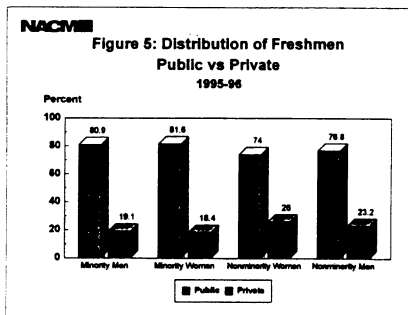
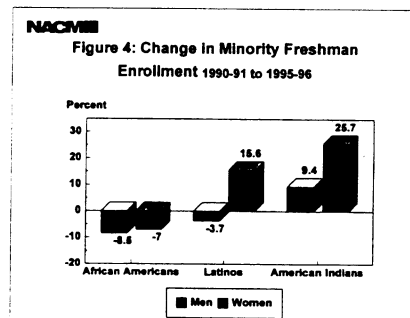
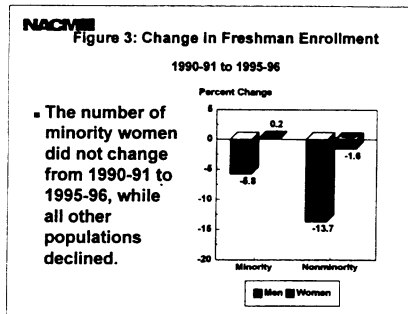
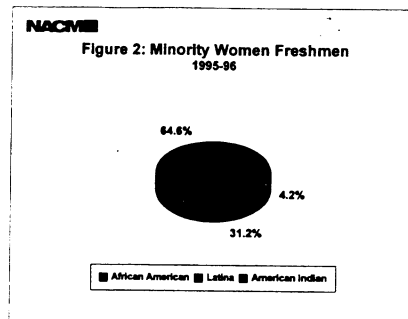
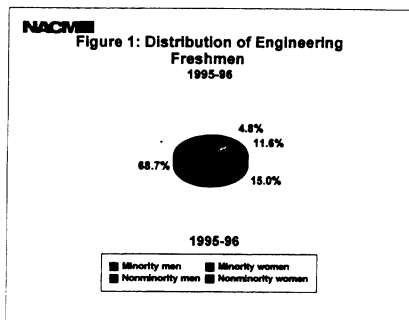
OVERVIEW OF MINORITY WOMEN IN THE FRESHMAN CLASS

Minority women constituted only 4.8 percent of the freshman engineering class in 1995-96 (Figure 1). Among minority women, African American women comprised the largest group, 64.6 percent (Figure 2). Figure 3 shows that over the last six years, the



WOMEN IN ENGINEERING CONFERENCE: CAPITALIZING ON TODAY'S CHALLENGES

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number of minority women stayed stable, while the minority male freshman population declined (5.8 percent). The total nonminority freshman population also declined, with nonminority women decreasing by a smaller proportion (1.6 percent) than nonminority men (13.7 percent).

The number of African American women in the freshman class declined by 7.0 percent from 2,768 in 1990-91 to 2,574 in 1995-96 (See Figure 4). This decline paralleled the decrease of 8.5 percent in the number of African American male engineering freshmen. Nationally, however, the number of African American freshmen in departments outside engineering increased over this time period. Latinas, unlike their male counterparts whose numbers fell by 3.7 percent, increased their numbers by 15.6 percent. The numbers of American Indian women and men increased by 25.7 percent and 9.4 percent respectively.

To test the hypothesis that the distribution of minority women and minority men is more closely correlated than the distribution of minority women and nonminority women, we first explored the demographics of the freshman class in individual institutions using correlation tests, excluding the Historically Black Colleges and Universities (HBCUs) and the Hispanic Association of Colleges and Universities (HACUs). We found that schools that enroll high numbers of minority women usually are the same schools with a large minority male population.

One explanation for this relationship could be the demographics of the states in which the schools are located. So we tested the relationship between the distribution of minority women in the freshman class and the distribution of minority women in the college age population by state,² and found that the higher the number and percent of minority women in the state, the higher the number and percent of minority women in the freshman class for engineering schools within those states.

To explore individual institutions, we ranked engineering schools by the number of minority women, nonminority women and minority men they enrolled in the freshman class and compared these rankings. With the exception of three institutions, the listings of the top 30 institutions were identical for minority men and women. Comparing the rankings of institutions with the most minority women to those with the most nonminority women, we find only 9 institutions appeared on both lists while 42 institutions were different.

Distribution of Freshmen by Type of Institution

To more closely examine parallel enrollment patterns, we classified engineering institutions into five categories: a) public and private schools³ b) minority serving institutions defined as HBCUs⁴ or HACUs⁵ c) research institutions⁶ d) institutions defined by cost and e) institutions defined by selectivity. The freshman population



distributions were compared separately for each, since these categories are not mutually exclusive.

Public and Private Institutions: The majority of all students attend public institutions (Figure 5). However, a larger proportion (four fifths) of minority men and women attend public schools compared with three-fourths of nonminority men and women.

HBCUs and HACUs: Similar proportions (approximately 30 percent) of the minority male and female populations attend the HBCUs and HACUs (Figure 6).

Research Institutions: More than half of nonminority men and women attend research institutes, while less than half of minority of male and female populations attend these schools (Figure 7).

Institutions By Cost: Dividing engineering schools into three equal groups based on cost, we found that most minority women and men (45 to 50 percent) attend low cost institutions (Figure 8), while most nonminority men and women attend medium cost institutions (approximately 43 percent).

Institutions By Selectivity: Examining freshman enrollment among the five selectivity categories defined by the Peterson's Guide,⁷ we found no significant difference in the distribution of the four population groups, with most students attending moderately selective institutions.

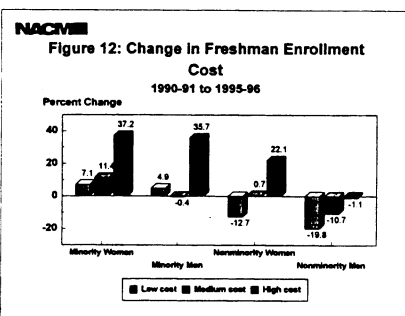
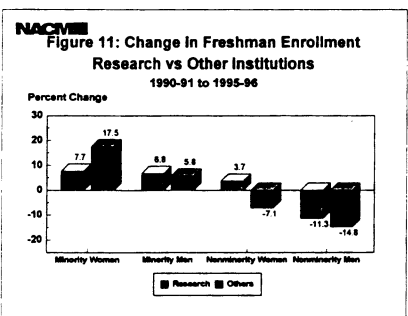
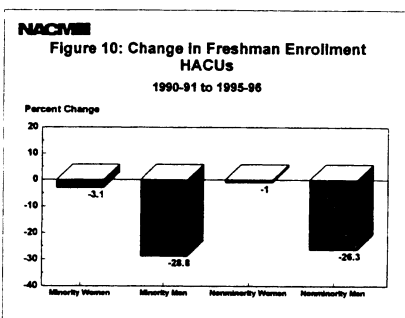
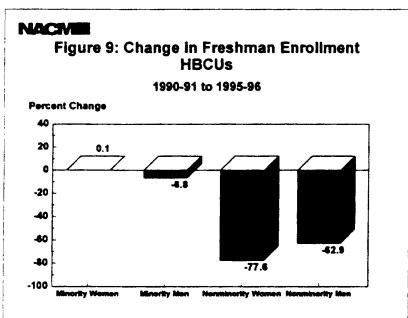
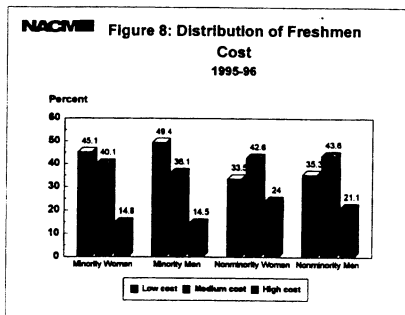
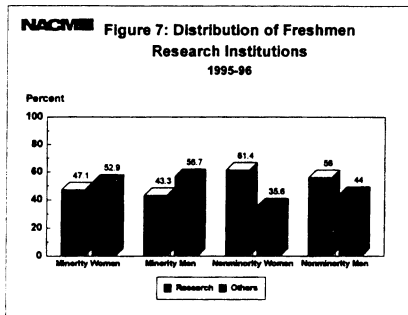
Overall, we found that both minority men and women are concentrated in low cost, public and minority serving institutions. Nonminority men and women in the freshman engineering class, while also concentrated in public institutions are mostly enrolled in the medium cost and research institutions.

Changes in Distribution of Freshmen by Type of Institution: 1990-91 to 1995-96

While the current distributions of minority men and women closely resemble each other, changes in these distributions over the last six years show both similarities and differences.

Public and Private Institutions: Over the last six years, the minority male and female populations have increased in the highest proportions in the private institutions.

HBCUs and HACUs: In the HBCUs, the number of minority women remained stable (Figure 9) while minority men declined (6.8 percent). Both nonminority male and female populations declined steeply (by two-thirds). The decline in minority freshmen in the HBCUs, as with the decline nationally, is not occurring in fields outside engineering. The HACUs present a slightly different picture (Figure 10) with both male populations



Source: National Action Council for Minorities in Engineering, Inc., New York, NY

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declining in significantly larger proportions than the female populations.

Research Institutions: The number of minority women and men increased by approximately 7 percent in research institutions, while the nonminority female population also increased but to a lesser extent (Figure 11). The nonminority male and female populations decreased in the non research institutions.

Institutions By Cost: Despite a concentration of the minority populations in low cost institutions, the highest increases in both the minority male and female populations (of more than 35 percent) have taken place in the high cost category (Figure 12).

Institutions By Selectivity: Despite few differences in the distribution of the four population groups across selectivity categories, the changes in these distributions show significant differences (Figure 13 and 14). The number of minority women increased by the largest proportions (54.8 percent) in the most competitive schools and in the noncompetitive schools (51.5 percent). Minority men increased to a lesser extent in the most competitive schools (5.0 percent) and most in the noncompetitive schools (37.1 percent). The nonminority female population, like the minority female population, increased the most in the competitive schools (36.9 percent).

Over the past six years, minority men and women have declined in numbers in the minority serving institutions, while increases in the minority freshman population during this time period have taken place in the more expensive private institutions and in research institutions. Minority women have increased in large proportions at the most selective institutions.

Conclusions

Data on enrollment in the engineering freshman class shows a strong relationship between the distribution of minority men and the distribution of minority women. The distribution of minority women in the freshman class relates closely to the demographic distribution of the minority population across the United States.

The symmetry between the distribution of minority women and the distribution of minority men emerges when we analyze these distributions on a university by university basis and across institutional categories. Both populations are concentrated in low cost, public institutions, minority serving institutions and non research institutions. The nonminority populations, on the other hand, are contained in medium cost, public and research institutions.

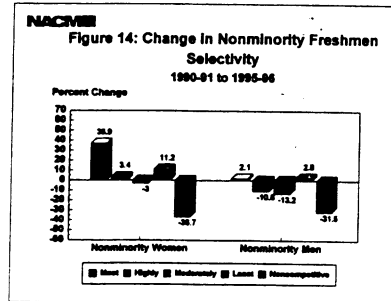
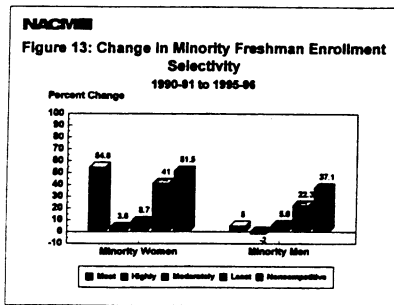
Over the last six years, changes across institutional categories showed different trends for minority men, minority women, nonminority men and nonminority women. Minority women, while initially concentrated in low cost schools, have increased in the

largest proportions in the more expensive, private schools. They are also increasing in numbers in research institutions and the more selective institutions. Simultaneously, they have decreased in numbers at the minority serving institutions. Similar trends hold for minority men with several exceptions. They increased in substantially smaller proportions than minority women in the more selective schools and their numbers have fallen more steeply in the minority serving institutions. However, minority men also increased in numbers in the research institutions and in the private, high cost institutions. The nonminority female population shows similar trends to the minority female populations increasing in numbers, though in smaller proportions, at the research institutions and the private institutions. All women, minority and nonminority, are increasing in large proportions at the more selective institutions. This points to shifting engineering freshman populations within these institutional categories with fewer students attending the minority serving institutions and more attending research institutions and the highly selective, more expensive, private institutions.

Cost appears to be a major factor influencing the enrollment of minority women, with the largest numbers concentrated in the least expensive schools. Changes in the last six years lead us to ask whether the more expensive institutions are offering minority women better financial aid packages or whether an increasing number of minority men and women can now afford the more expensive schools. National increases in the amount of student borrowing raise further questions about whether minority men and women are now willing to incur more debt to attend the most expensive schools. In the light of rising tuition costs at all universities, another area for research would be to examine the differential financial aid packages being offered by public and private schools.⁸

Among minority women, the declines in freshman engineering enrollment in the last six years have been mainly in the African American population and increases have been led by Latinas. The decline in the number of African American women was paralleled by a decline among their male counterparts. This decrease took place to a large extent within the HBCUs. The decrease in African American freshman enrollment in engineering runs counter to the national enrollment trends for African Americans and counter to trends in other departments in the HBCUs where freshman enrollment continues to grow. This points to a declining interest in engineering among African Americans and therefore, the need for more outreach and information aimed at this community on the opportunities available to those who earn a degree in this field.





ENDNOTES

1. George Campbell Jr., "Bridging the Ethnic and Gender Gaps in Engineering." *NACME Research letter*, New York, May 1996. Also, George Campbell Jr., "The Gender Gap in Engineering." *NACME Research Letter*, New York, May 1992.
2. *General Population Characteristics*, Table 28, Age and Sex for Race by Hispanic Origins, U.S. Census, 1990. Census data on the college age population was only available on a state by state basis.
3. *Peterson's Guide to Four Year Colleges*, Peterson's Guide Inc., Princeton, NJ, 1994.
4. "Historically and Predominantly Black Colleges and Universities," list produced by United Negro College Fund, Inc. Educational Services Department, New York, NY, 1991.
5. *1993-94 Directory of Hispanic Serving Institutions and Associate Members*, Hispanic Association of Colleges and Universities (HACU), San Antonio, TX., 1992.
6. Jean Evangelauf, "A New Carnegie Classification." *The Chronicle of Higher Education*, April 6, 1994. These institutions offer a full range of baccalaureate programs, are committed to graduate education through the doctorate, and give high priority to research. They award 50 or more doctoral degrees each year. In addition, they receive annually more than \$15 million or more in federal support.
7. *Peterson's Guide to Four Year Colleges*, Peterson's Guide Inc., Princeton, NJ, 1994.
8. *College Debt and the American Family*. The Education Resources Institute and The Institute for Higher Education Policy, Boston, MA: Sept., 1995.