

Leveraging Scholarships to Narrow the Retention Gap between Postsecondary Minority and Non-minority Students Enrolled in Engineering

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Abstract—Although undergraduate engineering enrollments soared through the mid-1990s, a persistent and significant achievement gap continues to grow. Only two of five minority students nationally who enroll in engineering graduate with a baccalaureate degree in engineering, compared to two of three non-minority students. Barriers to minority student retention continue to be: the cost of education, isolating campus environments, a lack of peer and faculty engagement, and inadequate math and science preparation.

Through its Partner University Block Grant program, NACME has established formal relationships with selected universities to support a cohort of at least ten students over five years, set performance parameters and metrics, and challenged each institution to leverage the funds to support and graduate even more minority engineering students.

Performance metrics include annual retention and graduation rates, GPA, and internship experiences (disaggregated by race/ethnicity and gender), as well as 5-year productivity. These measures are benchmarked against national institutional enrollment, retention, and graduation trends. While not imposing rigid criteria, NACME expects evidence of continuous improvement toward parity, including progressive rise in GPA, reduction in the minority-nonminority retention gap, and stable or decreasing time to degree.

The challenge remains — what structures and practices support minority engineering student success? How can they be replicated at engineering institutions across the nation? This presentation will report on NACME's one year (beyond baseline) of experience and progress with 13 Block Grant institutions. It will include an overview of the program goals, the conditions of the award and the metrics that has been established to measure institutional performance. Additionally, lessons learned and best practices will also be highlighted.

Introduction

Thirty years ago, a report titled, *Minorities in Engineering, The Blueprint for Action* (**Alfred P. Sloan Foundation, 1974**) was published by an independent task force charged with developing guidelines to increase the participation of underrepresented minorities in engineering. This report revealed that the barriers that prevented minorities from pursuing an engineering career were:

- inadequate math and science preparation;
- lack of awareness about engineering as a career;

- the cost of a college education; and an
- inhospitable campus environments.

Attaining a college degree is a coveted resource. Receiving a postsecondary education allows an individual to improve one's prospects to be successful both professionally and personally. As the generation from the 1950s and 1960s prepares to retire, a degree from a postsecondary institution provides access to career opportunities in a nation with a growing need for engineers, scientists and other technically trained workers. Therefore, minority and non-minority student postsecondary access and graduation are issues of immediate relevance and importance.

The challenges that were described in, *The Blueprint for Action*, continue to plague minorities as they face similar hurdles as those that existed in 1974...*inadequate math and science preparation*. The implications for the engineering workforce are significant as the average age of the science and engineering workforce is rising and the total number of retirements among science- and engineering-degreed workers will dramatically increase over the next 20 years (**Jackson, 2003**). These developments are taking place as the nation will experience a surge in the number of high school graduates with a peak of nearly 3 million graduates in 2008 (**WICHE 2003**). An increasing percentage of these high school graduates will be qualified to attend college. However, most of the growth in the college-qualified high school graduates will occur among minority, low-income, first-generation (to attend college) students who are in need of grant aid (**The Institute for Higher Education Policy and Scholarship America, May 2004**).

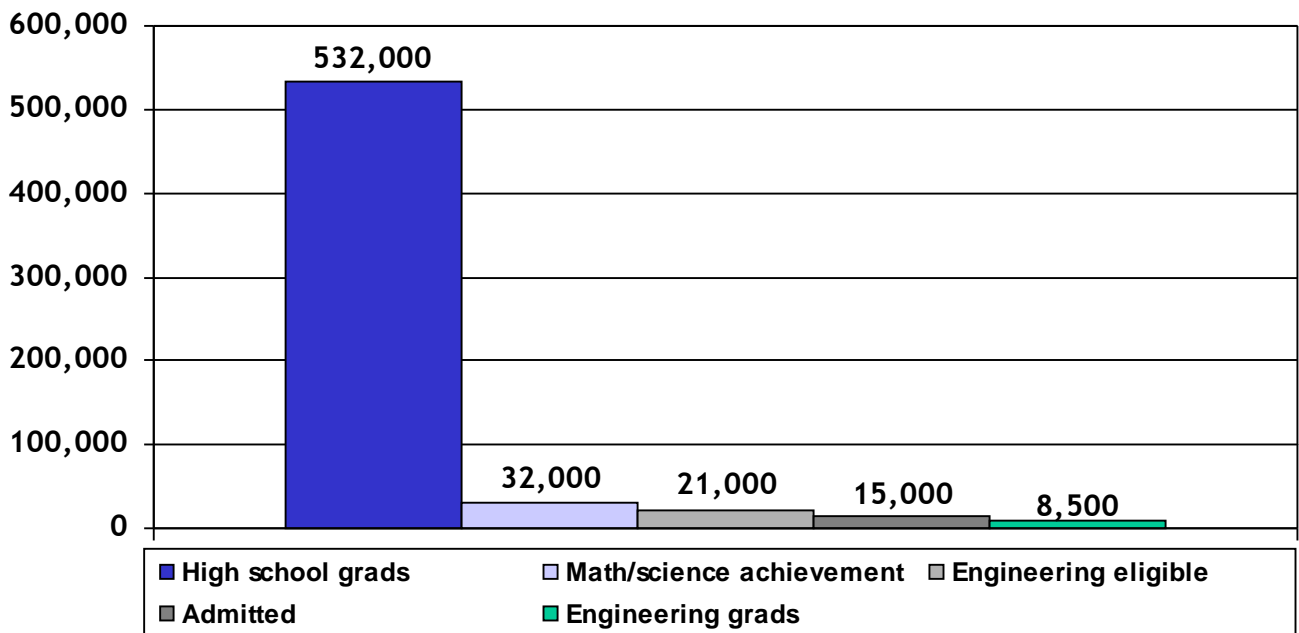
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NACME's founders estimated that it would take 10 years for minority representation in engineering graduates to mirror that of the college- age population. This goal to achieve parity remains elusive. In 2003, African Americans, American Indians and Latinos — one-third of the collage-age population and NACME's core group—represented only 10 percent of all engineering graduates and only 6 percent of the engineering workforce.

In recent years, some progress has been made as there is a slight increase in the number of minority students earning bachelor degrees, however, there continues to be under-representation of minorities in engineering. Kindergarten through High School (K-12) education is an important factor in determining whether students pursue (and attain) science and engineering degrees. A half-million minority students graduated from high school in 2000; yet, only 4 percent completed the requisite math and science proficiency for admission to an engineering program.

The number of minority students who succeed in advanced high school math and science curricula is disproportionately small. Many of those who do excel in these high school courses select engineering as a career choice. Seven out of ten minority students who achieve a high level of proficiency in the math and science (engineering eligible) stated that their intended major was engineering and were admitted to an engineering program (See Chart I.) Going forward, it is imperative that more middle and high school students be required to take the prerequisite classes that prepare them for careers in science and engineering.

Chart 1: Minority High School Graduates with math and science proficiency to be admitted to engineering and the college persistence rate



Source: NACME with assistance of Commission for Professionals in Science and Technology (CPST), data derived from the National Center for Education Statistics, Common Core of Data and NAEP Assessment and Engineering Workforce Commission. High school grad/engineering admits, 1998; Graduates, 2003. Excludes Puerto Rico.

This document provides a framework for guiding NACME's programs to help fulfill the mission of increasing minority preparation and participation in the engineering workforce. It describes four strategies to accelerate and sustain attainment of NACME's mission:

- establish and grow partnerships;
- build institutional capability;
- learn from NACME's programs; and
- transfer and adapt knowledge.

Although postsecondary minority enrollments soared through the mid-1990s, a persistent and significant achievement gap continues to grow. Only two of five minority students nationally who enroll in engineering graduate with a baccalaureate degree in engineering, compared to two of three non-minority students. Barriers to minority student retention continue to be: the cost of education, isolating campus environments, a lack of peer and faculty engagement, and inadequate math and science preparation (NACME, Inc. 2002).

Student Support Strategy

NACME has learned from its program operation experience that retaining students –from first year to graduation requires a cumulative experience that continues to build through one's college career. Scholarships alone will not suffice. NACME intervenes through its partners, to provide

financial assistance as well as internal support (e.g. mentoring, peer tutoring, internship experiences). NACME's goal is to boost enrollment and retention as well completion of the baccalaureate degree (**Chubin and Walter, 2002**).

Interventions such as NACME's are essential. The organization aims to strengthen partnerships to increase the representation of minority students in engineering with a vision to bridging the retention-to-graduation gap in engineering. In addition, NACME interventions and partnership help address the disparity created by the experience that several minority students face, such as graduating from schools lacking experienced teachers, standards-based curricula and materials as well as access to technology. Students who have had this experience frequently start behind and stay behind. They often lack role models, information and counseling. Yet they have potential that can be developed.

NACME's student support strategy relies on the capacity of its partner institutions. Lessons learned from years of managing scholarship programs has taught us that a block grant mechanism would afford the partner institution the greatest flexibility in coverage and administration of student costs. NACME seeks to leverage its scholarship dollars to impact more institutions and students. Given the variability in tuition, fees and books, NACME aims to stretch scarce resources and at the same time increase the number of students that can be supported under the block award.

A. Goals

When the strategy was implemented in 2003, the rate of growth proposed was 50 percent per year, from 9 partner institutions (participating in NACME's old scholarship program) to 21 schools in 2004-2005. The institutional roster has grown as follows:

<u>Academic Year</u>	<u>Number of Schools</u>
2002-2003	9
2003-2004	14
2004-2005	21

The goal to grow the number of partner institutions by 50 percent each year has been exceeded. With the addition of three new partner schools in 2004-2005, NACME has a total of 25 partner schools. The organization is now poised to launch a program expansion plan over the next three years. This expansion will focus on developing new partnerships with academic institutions that demonstrate a commitment to minority engineering student success.

Performance outcomes would reflect the following:

- Participating universities will graduate at least 70 percent of the NACME scholars who entered their universities in 2003 and have an overall minority retention rate that increasingly approaches the non-minority retention rate.
- The B.S. engineering graduation rates for NACME scholars in all participating universities will exceed the national average for minorities.

- The retention rate of NACME scholars who entered their universities in 2003 will equal that of non-minority engineering students, with no significant increase in time to degree (average time to degree for first year students is 5 years).
- Participating universities will graduate 90 percent of the NACME scholars who transfer from a two-year college.

Performance metrics include annual review of retention and graduation rates, GPA and internship experiences (disaggregated by race/ethnicity and gender). These measures will be benchmarked against national institutional enrollment, retention and graduation trends. NACME expects evidence of continuous improvement in reduction in the minority nonminority retention gap and a stable or decreasing time to degree.

B. Institutional Role and Accountability

Under the Block Grant, NACME's expectations include the selection and delivery of scholarships to each student up of to \$3,000 per year for four years (if necessary, a fifth year). Each cohort, after the first year of support, will achieve an aggregate cumulative GPA of 2.5/4.0 and would rise every year with a 2.6 (second year) 2.7 (third year), and 2.8 for the fourth year.

C. NACME Role

NACME has identified institutions of higher education with structures and practices that support minority student success in engineering. These academic environments emphasize quality instruction and learning experiences vary across public, private, large, and small institutions. The common thrusts that occur among partner institutions are a focused effort to engage students successfully in the academic process. NACME's self-imposed role is to establish clear expectations and guidelines with specific and measurable outcomes. The expectations include the disbursement of scholarship dollars to eligible students. First-year students are eligible for up to five years of scholarship support. Two-year transfers and currently enrolled sophomores and beyond would be eligible for annual support for up to three years. All students are expected to achieve academic excellence as they progress toward earning the baccalaureate degree in engineering. Each participating institution's graduation rate will be compared to annual rates for all NACME participating institutions. By leveraging scholarship dollars to program expectations, the organization aims to provide both leadership and support to the effort to dramatically increase the representation of minority engineers.

Baseline Measurement

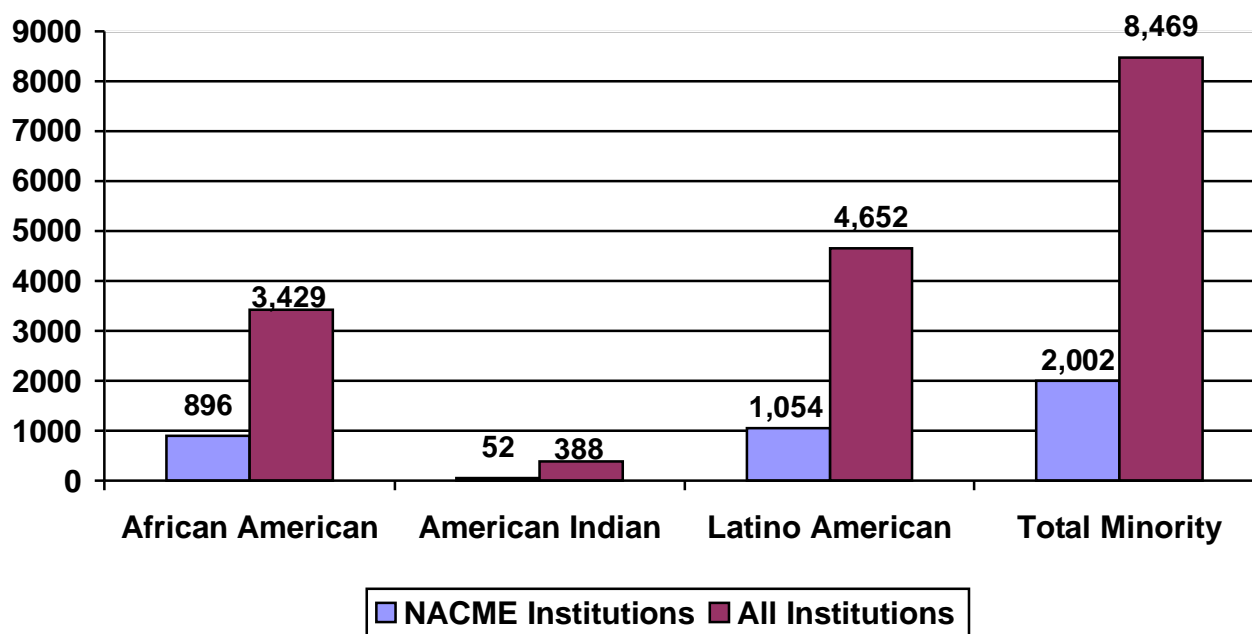
Before implementing NACME's Block grant at each partner institution baseline enrollment and retention-to-graduation data were established at each institution. A composite of the baseline data indicates that in 2002-2003 NACME's academic partners enrolled 22 percent of the nation's postsecondary minority students in engineering (See Table 1).

Table 1: 2002-2003 Engineering Student Full-time Enrollment (FTE) by Race/Ethnicity at NACME partner institutions as a percentage of engineering enrollments nationally			
Ethnicity	# FTE Enrolled at NACME Partner Institutions	# FTE Enrolled Nationally	Percentage FTE Enrollment
African American	5,611	23,346	24%
American Indian	335	2,135	16%
Latino	7,026	30,199	23%
Nonminority	71,675	328,932	22%

Source: NACME with data provided by CPST, 2005

Overall, NACME institutions graduated 26% of African Americans, 13% of American Indians and 23% of Latino Americans. In aggregate these 25 institutions graduated 24 percent of all minority engineers nationally in 2003 (See Chart 2).

Chart 2: Engineering BS Degrees by Race and Ethnicity at NACME Partner Institutions compared to Minority Graduates Nationally (2003)

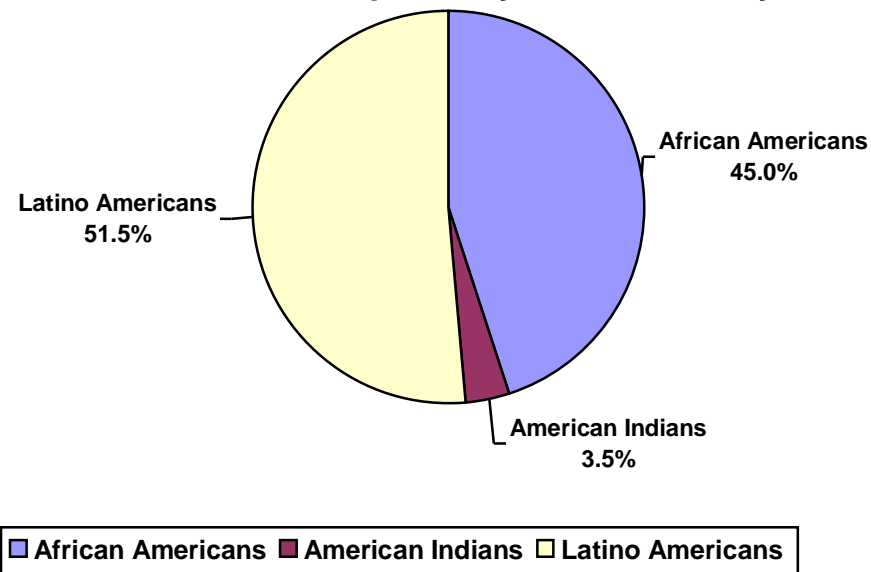


Source: NACME with data provided by CPST, 2005

First Year Outcomes

After the first year of implementing the Block Grant Program, NACME has collected first year results. Although it is too early to develop trends in retention-to-graduation rates at partner schools, it is possible to develop a profile of the current student population (See Charts 3-5) (Russo, 2004).

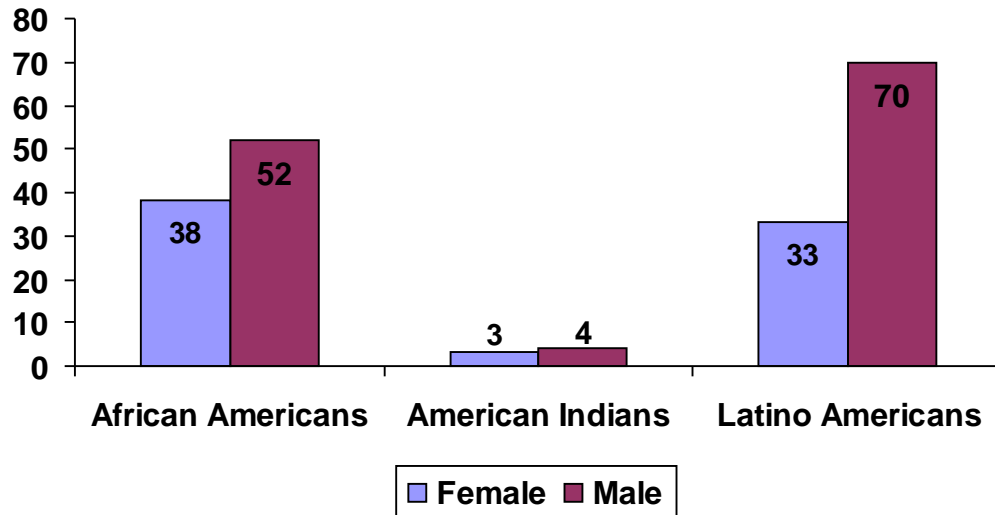
Chart 3: Student Participants by Race/Ethnicity



Source: NACME Population: 200

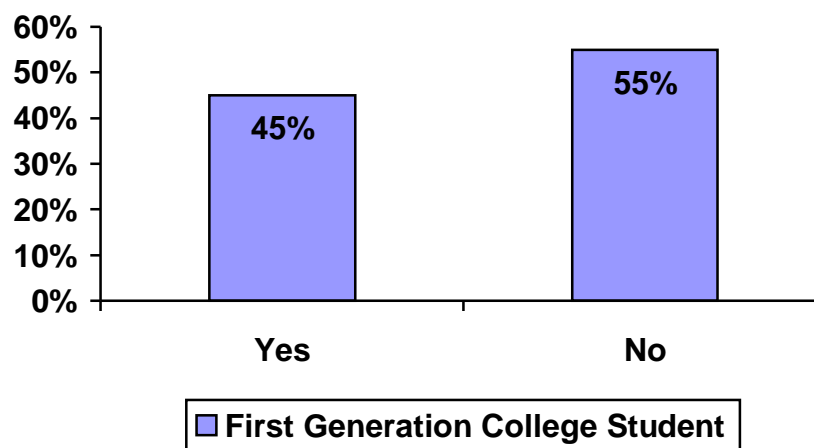
Latino Americans are the largest minority group of NACME Scholars. This is consistent with the distribution of minority engineering students nationally — Latino Americans and African Americans represent 54% and 42% of the minority undergraduate engineering student enrollments, respectively.

Chart 4: Number of Student Participants by Gender and Race/Ethnicity



Proportionally more female African Americans than female Latino Americans are NACME Scholars. Proportionally more male Latino Americans than male African Americans are NACME Scholars.

Chart 5: Percentage of Student Participants as First Generation College Students



Source: NACME Population: 200

Forty-five percent of NACME Scholars are first generation college students.

Summary of Findings

The highlights from the first year's experience indicate that NACME Scholar program is providing much needed access to engineering programs for students with demonstrated financial need, particularly for Latino and African Americans. Proportionally more Latino American males than African American males are NACME Scholars. First year results show that NACME Scholarship provided significantly higher levels of access to engineering programs for all female minority students, particularly African American females. Approximately 25 percent of NACME Scholars were identified via the transfer student (from two-year colleges) process. However, the levels of the internship and research engagements extended to NACME Scholars are surprisingly low. However, twenty- nine percent of the population are first-year students; this might explain the low internship and research participation rate.

Next Steps

NACME plans to convene annual meetings with partner institutions to facilitate the exchange of best practices in recruitment, enrollment, retention and graduation of minority students enrolled in engineering. The findings from these partnerships will be compiled and shared among the engineering community.

Chubin, Daryl E. and Walter, Aileen M. *NACME Student Support Strategy (Block Grant) Report*, 2002

Jackson, Shirley A., *A Critical Mass for Making a Difference, Pan-Organizational Summit On The U.S. Science Engineering Workforce*, 2003 (p.206)

Russo, Rocco P., *NACME Student Support Strategy (Block Grant) Program; Selected charts from presentation at NACME Institutional Partner Workshop in Atlanta, Georgia, November 18-19, 2004*

The Alfred P. Sloan Foundation, *Minorities in Engineering, The Blueprint for Action*, Library of Congress Catalogue Card No. 74-22338, 2974

The Institute for Higher Education Policy and Scholarship America, *Investing in America's Future—Why Student Aid Pays off for Society and Individuals*, May 2004 (p.17)

Western Interstate Commission for Higher Education (WICHE), *Knocking at the College Door*, December 2003 (p.3)

The National Action Council For Minorities in Engineering (NACME, Inc.): *Based on literature as summarized at the Merck-NACME Think Tank on Retention*, New York, NY April 11, 2002 (p.4)

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