A Model for Ensuring Diversity in Engineering Recruiting and Scholarship Administration

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Abstract *- The College of Engineering at NC State University, located in Raleigh, NC, USA, attracts some of the most talented high school students in the country. Each year, an entering freshman class of over 1200 new engineering students includes approximately 18% women and 20% minority students. The entire College of Engineering undergraduate and graduate enrollment of 7200 students comprises 19% women and 20% minority students. While our international reputation as a top-tier engineering university, coupled with academic scholarships, continue to attract a diverse set of entering freshmen, like other public engineering universities, recent changes affecting the management and administration of race-based scholarships pose serious recruiting challenges. The NC State University College of Engineering has a long, rich tradition of recruiting, nurturing and graduating minority engineering students. As the national trend of declining enrollments of all students in engineering continues, our College of Engineering has managed to maintain or buck the trend by showing steady increases in our enrollment numbers and graduation rates. In 1997, in anticipation of pending changes to race-based scholarship administration procedures, our College of Engineering administration made a bold yet strong restructuring to help insure a diverse student engineering population. After presenting an overview and enrollment profile discussion of our college, this paper will describe this administrative restructuring and its continuing impact on engineering diversity at NC State University. The paper continues with discussions of how these changes have altered other administrative units on campus, and a summary of our national engineering profile. The paper concludes with a discussion of challenges to continued success in student recruiting, retentions and graduation.*

Index Terms – *diversity, engineering education, model, recruiting*

INTRODUCTION

Through its responsibility as a land grant university the College of Engineering at North Carolina State University seeks to recruit the highest achievers while maintaining a diverse and inclusive campus community. Our enrollment rates of underrepresented students (African-Americans, Hispanic Americans, American Indians) have increased steadily over the past twenty years. The NC State University Minority-engineering Programs Office was established in 1982 to address the needs of a growing number of students attending the university, with particular emphasis on underrepresented student success. As success was proven with our model, it was replicated across campus in other schools and colleges. Research has shown that first year student success is highly dependent on support services and programs, particularly for minority students [1, 2].

CURRENT NATIONAL AND LOCAL MINORITY ENGINEERING STUDENT STATUS

According to the most comprehensive data recently released by the National Action Council for Minorities in Engineering [NACME], Inc., freshman enrollment, the gateway through which minorities enter the engineering profession, is considerably smaller today than it was several years ago. From a peak enrollment of 15,181 African-American, Latino and American Indian freshmen in 1992-93, minority freshman enrollment declined 8.2 percent, dropping to 13,929 in 1997-98. As a share of the class, minority students lost ground also, falling from 16.4 percent of all freshmen who enrolled in 1992-93, to 15.7 percent in 1997-98. Not surprisingly, for both African-Americans and Latinos losses were concentrated among engineering institutions enrolling the largest numbers of, and providing the greatest access to, minorities [3].

While historically black colleges and universities (HBCUs) continue to enroll and graduate the largest share of African-American engineers [4], employment opportunities, aggressive recruiting and the comprehensive nature of major traditional white institutions (TWI) contribute to the increased opportunities for African-Americans to earn engineering degrees at these institutions.

For decades several programs at the national and local levels have been developed and attempted to help meet the projected shortage anticipated in an ever-increasing high-technology work force. In 1998, Bowen and Bok published results of a comprehensive longitudinal study of one specific, significant thrust at addressing minority student success: affirmative

action. Their study [3] provides defensible, concrete proof of the positive impact affirmative action has had not just on minority participants, but also on society as a whole. While such results are notable from a historical perspective, anyone serious about minority student success will quickly acknowledge that there remains tremendous work to be done in reaching a point where access to education, and a diverse, well-prepared work force pool, are assured.

In correspondence to our College of Engineering associated with the transmittal of a grant from its new Minority Engineering Recruitment and Retention Initiative, top-level officials of a major international high-technology employer expressed its industry's diversity sentiment succinctly by stating, "We believe in the future that we are all trying to build together. We believe that this world will only reach its full potential when those of us of like mind put our commitment, our spirit and our resources behind the development of young people, who will ultimately lead the way. Clearly these individuals must look like the mosaic that our world has become." [4]

The State of North Carolina had been at the forefront in implementing progressive programs and initiatives that address minority student success. At its 1998 annual conference in Washington, D.C., the Quality Education for Minorities (QEM) Network released a national action plan [6] developed in conjunction with North Carolina. This action plan is designed to enhance North Carolina's likelihood at meeting or exceeding its "fair share" of the new science, engineering and mathematics minorities entering the national workforce. Along with the release of the action plan and its companion Top Ten Colleges and Universities Report [7], QEM officials honored North Carolina for "helping lead the nation" in production of minority undergraduates in mathematics, science and engineering. As one of the 16 institutes of higher education so recognized, NC State University's College of Engineering set the pace.

INTRODUCTION TO THE UNIVERSITY AND COLLEGE OF ENGINEERING

At NC State University, we have developed a student success model that is contributing towards our goal of increasing student diversity in the engineering and computer science professions. We know we are on the right track because our NC State University College of Engineering has been honored twice in the short, four-year history of a national mentoring awards program. In 2000, we received our second Presidential Award for Excellence in Science, Mathematics and Engineering Mentoring [8]. Two of our African American engineering professors won individual Presidential Mentoring awards in 1997 and 2004 for their contributions to the success of under-represented minority students earning engineering graduate degrees [9, 10].

For over five years, our Minority Engineering Programs (MEP) have been evolving as a national model for engineering student success. Refereed paper presentations on our model have been made in recent years at annual conferences of the American Society of Engineering Education [11], Frontiers in Education [12], and the International Conference on Engineering Education [13-15].

The NC State University College of Engineering College comprises 10 departments offering 16 BS, 17 MS, and 14 Ph.D. degrees programs and conducts the largest undergraduate and graduate engineering education and research programs in the State. The College continues to rank among the nation's leading colleges in the total number of degrees awarded, the number of degrees awarded to women and minorities, the quality of the graduate programs, and research and extension activities. The College ranks seventh nationally in the number of undergraduate engineering degrees awarded. With a fall 2003 undergraduate enrollment of enrollment of 5,620 (1,301 freshmen, 1,145 sophomores, 1,269 juniors, 1,884 seniors, and 20 unclassified), the College of Engineering is the largest of the NC State campus units that make up the University enrollment of about 28,000. Each year, over 1200 new high school graduates enter the College of Engineering. Approximately 20% of each entering freshman class is members of a minority ethnic group. Total undergraduate minority engineering enrollment for fall 2003 includes 423 African-Americans, 153 Hispanics, and 41 Native Americans. Female students make up about 19% of the entering class of engineering students each fall. NC State University has the second largest African American engineering undergraduate enrollment of all non-Historically Black Colleges and Universities (HBCUs) in the nation. Among non-HBCUs, we award the second highest number of Bachelor of Science in engineering degrees to African-Americans.

Of the 521 faculty and research staff members, 221 are tenured/tenure-track faculty members; 18 are lecturers/instructors; 44 are visiting; 117 are adjunct Appointments; and 121 are non-faculty and other administrative staff.

ENGINEERING SCHOLARSHIP ADMINISTRATION

The Assistant Dean for Engineering Student Services and Director of Minority Engineering Programs has responsibility for the administration of all College of Engineering scholarships. By administering these funds in an integrated fashion, we have been able to increase both the quality and quantity of students in the College of Engineering. Our scholarships administrator works closely with university-level merit and need-based scholarship personnel to optimize use of scholarship funds available for recruiting engineering student. Scholarship awards decisions are made based on academic merit, and the funds

are matched to optimize any constraints associated with those funds. Management and monitoring of each recipient continues until either the student graduates, is no longer in engineering, or becomes ineligible for renewal awards.

This function works closely with university-level merit and need-based scholarship personnel to optimize use of scholarship funds available to recruit engineering student. The function also administers the engineering scholarship program that makes awards to entering freshmen and continuing engineering students. The function integrates all College of Engineering scholarships by managing restricted and unrestricted funds in a general pool. Awards decisions are made based on academic merit, and the funds are matched to optimize any constraints associated with those funds. Management and monitoring of each recipient continues until either the student graduates, is no longer in engineering, or becomes ineligible for renewal awards. Goal of this activity is to recruit and graduate the best qualified students possible so as to enhance our reputation as a national contributor to a high quality, diverse pool of engineers.

STUDENT SERVICES MAJOR PROGRAM ACTIVITIES

What follows is a partial summary of several activities in which our student scholars participate. These programs and activities are partially managed by our Assistant Dean and Director of Minority Engineering Programs. His involvement allows for assurance that not only is ethnic and gender diversity fairly considered in the scholarship selection process, but also insures participation by a diverse segment of our engineering student population.

1. Corporate and Industrial Associations

Annually, hundreds of our engineering, computer science, mathematics, and statistics students find projects or employment with the dozens of high-technology companies located within 15 miles of our campus. Some students find affiliation as a result of corporate mentoring or tracking programs associated with scholarships. Others do so through formal course projects or activity. A third group forms affiliations resulting from undergraduate or graduate research. Hundreds of students annually: some during summer months only, others during the academic year; some for hire and others for design course credits associated with their academic major.

2. Engineering Writing Assistance and Tutorial Programs

The College of Engineering has a full-time permanent professional staff member who manages our Writing Assistance and Tutorial Programs. This individual works aggressively and continuously with all students to improve their writing and academic course work performance. Assistance is available on a walk-in basis, individually or as a group. Students can obtain writing assistance with any writing effort, regardless of course or purpose. Resume writing is a key help-area, and is an integral part of special orientation courses designed for minority engineering students. Annually approximately 35 tutors serve over 375 students in over 1300 tutorial hours.

3. Research Experiences for Undergraduates

The summer research opportunity addresses retention, education and graduation rates of undergraduates by involving them in a focused research experience that exposes participants to a graduate/postgraduate research environment. Undergraduate students from minority institutions affiliated with an NSF-sponsored education or research alliance, are selected to take part in one program that takes place annually at North Carolina State University. Several other undergraduate students from our campus are selected to work in relevant research groups that advance science and engineering knowledge in one of several university research centers. Students who excel during the summer may remain in research projects during the academic year as their formal course work permits. Annually, approximately 100 undergraduate students are paid to work in research groups.

4. Student Advancement and Retention Teams

This student-centered program is an aggressive early intervention and peer-mentoring program for underrepresented engineering and computer science students. Compensated mentors chosen from among upper-class undergraduate engineering and computer science students, are each assigned five or six mentees. These mentors act as big brothers or big sisters to their mentees, meeting weekly as a START group to discuss academic and social maturation issues. Approximately 120 new engineering freshmen are assigned mentors for their freshman year. Fifteen – eighteen upper-class minority students are hired as mentors.

5. Student Engineering Outreach Teams

For the past three years, we have used Engineering Outreach Teams to assist with student recruiting and information sharing. These teams travel to K-12 learning institutions throughout the state. They carry with them an enthusiastic approach to hands-on learning experiences designed to both inform and excite students about the field of engineering. The students and

faculty comprising the teams are drawn heavily from our female and minority engineering student populations. Last year these teams of 3 – 4 students each made approximately 15 visits to schools with an average enrollment of 2200 students.

EXAMPLES OF SUCCESS AT ENHANCING STUDENT DIVERSITY USING THIS MODEL

What follows is a brief summary of tangible results of our formal, dedicated efforts that target minority-engineering student.

According to the National Action Council for Minorities in Engineering (NACME, Inc.), North Carolina State University awards the second highest number of engineering degrees to African-Americans of all traditionally white institutions in the nation [3]. This accomplishment is even more significant when one considers that the engineering program on our campus comprises approximately 25 percent of the total student population. At the number one university, nearly 70 percent of all students are majoring in engineering or computer science [3, 4].

Two of these African-American faculty members are recipients of the 1998 [9] and 2004 [10] Presidential Award for Excellence in Science, Engineering and Mathematics Mentoring. Another is the first and only winner of the US Air Force Research and Development Award for research work done in support the International Space Station [12].

At the graduate level, recent significant research contributions have been made by NC State College of Engineering African-American Ph.D. students in computer science [16], electrical engineering [17], and computer engineering [18]. The all-time national record of six Ph.D. degrees awarded in one year to African-American females by our engineering college resulted from a long-standing commitment to hiring, mentoring, promoting and celebrating a faculty that includes eight African-American professors. These faculty mentors and scholars provide additional credibility to campus-wide commitments through national recognition of their accomplishments.

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