

North Carolina State University Summer Transition Program – A High School to College Bridge Program for Enhancing Undergraduate Engineering Education

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Abstract: The NC State University College of Engineering is an internationally recognized producer of engineers and computer scientists who are prepared to make an immediate contribution to the workforce. Our research faculty are recognized around the world for cutting edge research. Essential to our mission and continued success is a steady stream of top-notch students who contribute to and celebrate ethnic, academic and gender diversity. Each year an entering freshman class of 1100 new engineering students includes 20% women and 20% under-represented minority students. The rate at which they persist through our undergraduate program is impacted by how they adapt during their first year. Following a successful recruiting cycle, we then invite targeted students to enter our engineering programs during the summer session as participants in the NC State University Summer Transition Program. The purpose of this program is to begin enhancing the academic and social maturation of incoming minority engineering freshmen prior to the start of the regular academic year. Fifty to 75 students participate in this program conducted during the second summer academic session. Participants receive instruction and where applicable, academic course credits in mathematics, English, and a science course. In addition, they gain early hands-on experience in engineering design, and an introduction to the College of Engineering computing environment. Weekly industry site visits introduce the students to opportunities available to them as they move through their undergraduate program and seek permanent employment. This paper provides a detailed description of this six-week summer bridge program. We present a summary of our national profile, and share data on the impact the program is having on the quality of our students as they persist toward graduation.

Key Words: minority, students, success, bridge program

1. National Profile of Minority Engineering Students

According to 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 five 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 [1]. While historically black colleges and universities (HBCUs) continue to enroll and graduate the largest share of African-American engineers [2], 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. A nationally acclaimed authority on minority engineering student success, and arguably most recognized expert in this area, has spent nearly 20 years developing models for engineering student success [3]. Here at NC State, we use this and other references to provide a unique, proven success model for all our engineering students [4].

2. Campus Engineering Environment and Demographics

The College of Engineering comprises 10 departments offering 16 BS, 17 MS, and 14 Ph.D. degree 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 [1], [2], [5].

Of the 521 faculty and research staff members, 219 are tenured/tenure-track (rank of assistant professor or above) faculty members; 18 are lecturers/instructors; 44 are visiting; 119 are adjunct appointments; and 121 are other non-faculty and staff.

With a spring 2000 enrollment of enrollment of 5,097 (1,017 freshmen, 1,172 sophomores, 1,214 juniors, 1,716 seniors, and 18 unclassified), the College of Engineering is the largest of the NC State campus units that make up the University enrollment of about 27,000. Total undergraduate minority engineering enrollment for spring 2000 includes 548 African-Americans, 129 Hispanics, and 39 Native Americans. 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.

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Following a successful recruiting cycle, we then invite targeted students to enter our engineering programs during the summer session as participants in the NC State University Summer Transition Program. The purpose of this program is to begin enhancing the academic and social maturation of incoming minority engineering freshmen prior to the start of the regular academic year. Fifty to 75 students participate in this program conducted during the second summer academic session. Participants receive instruction and where applicable, academic course credits in mathematics, English, and a science course. In addition, they gain early hands-on experience in engineering design, and an introduction to the College of Engineering computing environment. Weekly industry site visits introduce the students to opportunities available to them as they move through their undergraduate program and seek permanent employment. This paper provides a detailed description of this six-week summer bridge program. We present a summary of our national profile, and share data on the impact the program is having on the quality of our students as they persist toward graduation.

3. Summer Transition Program Selection and Orientation

After recruiting incoming minority engineering freshmen, the Minority Engineering Programs Office offers a gamut of programs and services to the students. The first of these is our Summer Transition Program (STP), the primary purpose for this paper. In the spring the Minority Engineering Program staff identifies all accepted minority freshmen, normally between 230-275 students. All of these students are sent preliminary information on our program in the form of a "Ticket to Success" (Figures 1a and 1b contain the content of this form).

This package makes them aware of the existence of our Minority Engineering Programs Office and targeted programs, and alerts them to arrival of more extensive STP mailing package. Approximately two weeks later a letter to the parents and student inviting him/her to apply to the program, an application, a student profile survey, and a summary of the schedule is sent to all of the admitted students. At the beginning of June, fifty to 75 students are selected to participate in this comprehensive six week program held during the second summer session. Usually one day before the formal summer academic session begins, program orientation is held for the accepted students and parents.

In parallel with managing the process for inviting and selecting prospective students to participate in the program, the MEPO staff also begins to assemble the STP support staff. Fifteen to 20 counselors, selected from among undergraduate minority engineering students, are identified as key staff members for this program. They become an integral part of the planning and execution portions of STP. Likewise, coordination occurs with campus academic staff and department members to insure sufficient teachers, tutors, and mentors are available for the academic

courses these new students will be exposed to. Once detailed plans are completed, the operating budget is prepared, and funding sources identifies.



Figure 1a. Front Cover of “Ticket to Success”

Get an edge on the rest! Take advantage of all that Engineering at North Carolina State University (NC State) has to offer. Apply to participate in the 2000 Summer Transition Program (STP) and get a jump start on your college career. STP 2000 is available to a select number of freshmen who have been admitted to NC State for the Fall 2000 semester.

What is STP? STP is an *intensive* six-week program, designed to assist incoming freshmen in making a smooth transition from high school to college. Through participation in STP, students will gain first hand experience on college life. Students will live in university housing during the program and enroll in one university course for credit. In addition, they will receive instruction on science and engineering fundamentals, mathematics, academic survival skills, computer applications, effective communication, and personal and professional development.

When is STP? Orientation for students and parents will be conducted July 3rd. The actual program will begin July 5th and end on August 11th.

Is there a cost for STP? The only expenses to in-state students are books, materials, meals, and transportation costs. If you are an out-of-state student you will be responsible for the same expenses as in-state students, in addition to the out-of-state portion of tuition which may range from \$1080 to \$1440, depending upon in which math course you enroll. All housing, courses (except as indicated for out-of-state students), and student enrichment activities are free of charge. Students who complete all activities will receive a \$500.00 scholarship at the conclusion of the program, if and only if, he or she enrolls at NC State University during the Fall 2000 semester.

How can you participate in STP? Watch your mailbox for the next mailing, which will include additional program information, a program schedule and an application.

Figure 1b. Inside STP “Ticket to Success” Content

A major component of the budget is the cost of housing for the 50 – 75 student participants, and the 15 – 20 counselors and other support staff needed to insure a successful program. The cost per student participant is approximately \$2000. The only expenses to in-state students are books, materials, meals, and transportation costs. Out-of-state students are responsible for the same expenses as in-state students, in addition to the out-of-state portion of tuition which ranges from \$1080 to \$1440, depending upon in which math course the student is enrolled. All housing, courses (except as indicated for out-of-state students), and student enrichment activities are free of charge. Students who complete all activities receive a \$500.00 scholarship at the conclusion of the program, if and only if, he or she enrolls at NC State University College of Engineering during the fall academic semester.

4. NC State University Summer Transition Program Components

STP allows students to take two university courses. Whether their first course (mathematics) is college algebra, pre-calculus or Calculus I depends on the student mathematics placement scores. The other course is a science, usually physics or chemistry, but these do not replace the courses the student takes in the fall. They are preparatory classes to get students ready to take the regular fall chemistry course. In the afternoons, students attend Academic

Enhancement Workshops in math, English and chemistry or physics. The math and chemistry workshops are each twice per week and supplement the classes from earlier in the morning. Graduate students lead the chemistry and physics workshops. In the workshops, the students receive more one on one instruction. The English and physics workshops are stand-alone; they do not supplement a class. All students take English once per week. The students who take physics are the students who are also taking Calculus I. These students will be eligible to take physics earlier than the other STP participants. Students also take Introduction to the Computing Environment (E115) to learn how to use university computers. At the end of the summer, students have an opportunity to take a test and place out of E115 for the fall since they have already had exposure to the university computing environment during the program. These courses combine with a structured resident hall and weekly "Rap Sessions" that allow students to learn more about campus life, the community and academics. Three nights a week, Monday, Tuesday and Wednesday, the students have mandatory tutorials that they attend for math, chemistry and physics. The students also make weekly site visits to local industry. This gives the students an opportunity to experience a "real world" manufacturing setting and meet engineers that are working in their prospective field of study. At the end of the six weeks students who complete the program, and return to NC State University College of Engineering in the fall, receive a \$500 scholarship.

5. NC State University Summer Transition Program Staff

At the beginning of the spring semester before the program begins, the MEP staff begins to search for a Program Coordinator. Typically, we look for a Ph.D. student who is at a point in his/her curriculum where he/she can take a summer off from their research and work for the program. This person is put on payroll part-time throughout the remainder of the semester to plan the program. Coordinator activities include planning the class schedules, calling and identifying instructors, tutors, "Ra Session" topics, interviewing counselors and many other tasks. The academic instructors for math, chemistry and English workshops are NC State faculty and staff. Graduate students teach the math and physics workshops. The Introduction to Computing class is taught by two students, normally undergraduates who have had the appropriate training. The math, chemistry and physics tutorials are facilitated by a combination of both graduate and undergraduate students.

6. Summary of Results

As the national trend of declining enrollments of all students in engineering, and particularly minority students continues, our College of Engineering has managed to maintain or buck the trend by showing steady increases in our enrollment numbers [1], [2]. An analysis of the degrees awarded to minority engineering students in 1997-98 reveals the following national rankings for the North Carolina State University College of Engineering: 1) First among all engineering programs in Ph.D. degrees awarded to African-American women; 2) Second in engineering BS degrees awarded to African-American students (excluding HBCUs); 3) Second (with Pennsylvania State University) among all engineering programs in Ph.D. degrees awarded to African-Americans; 4) Sixth among all engineering programs awarding engineering degrees to Native-Americans; and 5) Tenth among major engineering programs in MS degrees awarded to African-American students (excluding HBCUs) [1], [2], [7].

According to 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 [1]. This accomplishment is even more significant when one considers that the engineering program on our campus comprises approximately 28 percent of the total student population. At the number one university, nearly 66 percent of all students are majoring in engineering [1], [2].

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 [8], electrical engineering [9], and computer engineering [10]. 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. One of these African-American faculty members was recognized by President Clinton as a recipient of the 1998 Presidential Award for Excellence in Science, Engineering and Mathematics Mentoring [11]. 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], [13].

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