

Helping Orient Minorities to Engineering (HOME) Program: A Pre-College Bridge Program

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Abstract - This complete evidence-based practice paper will describe the successes of the Helping Orient Minorities to Engineering Program in the College of Engineering at North Carolina Agricultural and Technical State University. This 5-1/2-week residential pre-college bridge program is used to recruit, retain, and graduate minority freshmen engineering and computer science students and to provide a sense of community. Since the inception in 2005, the HOME Program has recruited 189 students into the program. Each summer, a cohort of approximately 20 students are immersed into college life with the support of faculty, staff, and upperclassmen who serve as peer mentors.

During the HOME Program, students participate in intellectual, personal/professional, and cross-cultural development activities. The intellectual development occurs through enrollment in Calculus I, supplemental instruction support, and a team project. The personal/professional development occurs through networking opportunities and college-readiness workshops. The cross-cultural development occurs through early establishment of community and accountability with peer mentors. Activities are held throughout the academic year to continue engagement with the students.

As for data, the high school GPAs for both groups were within 0.2 points. The average first-year retention rate (Table II) for the HOME Program participants was 90% as compared to 81% for non-HOME participants. The average second-year retention rate (Table III) for the HOME Program participants was 91.6% as compared to 56.5% for non-HOME Program participants. Further, the average six-year graduation completion rate within the major for HOME Program participants was 66.6% (local database) as compared to 40% (Office of Institutional Research) for non-HOME participants. Depending on the cohort, the cumulative GPAs (Table IV) for HOME students ranged from 3.03 to 3.53 as compared to 2.23 to 3.1 for non-HOME Program students. For future study, the authors recommend evaluations at regular intervals with validated instruments as well as a longitudinal study.

Index Terms – College readiness, minority engineering, STEM, summer bridge program

INTRODUCTION

North Carolina Agricultural and Technical State University (NCATSU) is the largest public historically black college and

university in the nation with over 11,000 undergraduate and graduate students. NCATSU is an 1890 land-grant doctoral research institution located in Greensboro, North Carolina. The mission of the university is dedicated to learning, discovery, and community engagement. NCATSU is the nation's largest producer of African American bachelor of science graduates in engineering and computer science. The engineering and computer science programs are housed in the College of Engineering (COE).

The COE at NCATSU is home to seven different departments that include ten undergraduate engineering and computer science programs. The engineering programs include civil, architectural, chemical, biological, bioengineering, electrical, computer, industrial & systems, and mechanical. Also, included is the computer science program. The enrollment for the COE is currently over 1,700 undergraduate and graduate students. Of this total, female students make up 30% (Office of Institutional Research) of the student enrollment at the undergraduate level and graduate level.

The annual research expenditures for the COE exceeds 11.8 million dollars. As such, the COE is home to distinguished research centers including the National Science Foundation's Engineering Research Center for Revolutionizing Metallic Biomaterials, The Center for Advanced Studies in Identity Sciences, and The Testing, Evaluation, and Control of Heterogeneous Large-Scale Systems of Autonomous Vehicles Center. These research centers provide an array of undergraduate research opportunities for current engineering and computer science students. Equally important, the COE also provides academic support and student programming for its undergraduate students to be successful; one such program is the Helping Orient Minorities to Engineering (HOME).

The HOME Program, now a signature program in the COE began in 2005 with 10 students. Since the inception, the HOME Program has evolved to orient 189 students from all over the country. The HOME Program is a 5-1/2-week residential bridge program, for incoming freshmen engineering and computer science students. This recruitment and retention program seeks to attract and retain high achieving students in science, technology, engineering, and mathematics (STEM). While most bridge programs focus on providing remedial support for incoming freshmen, the HOME Program focuses on recruiting, retaining, and graduating high achieving students. Similar to the Challenge Program (bridge program) at Georgia Tech, the HOME Program, seeks to provide academic support and integration for its students [1]. Academic support is provided by offering supplemental instruction to HOME Program students. Student support for the

HOME Program includes peer and faculty mentoring, scholarships, internships, co-ops, and mentoring.

The impetus for launching the HOME Program was to recruit students from the Midwestern United States for the summer and to enroll them in the fall and spring at NCATSU. Subsequently, the students would spend their summers working for one of the HOME Program corporate sponsors near their hometown. The corporate sponsors wanted to hire the students for internships and cooperative experiences near their hometown and the COE wanted to increase enrollment. By deploying the HOME Program, both groups achieved their goal.

Each summer, a cohort of approximately 20 students are immersed into college life with the support of faculty, staff, and peer mentors. The HOME Program allows incoming freshmen an opportunity to participate in intellectual, professional, and cross-cultural development activities. All HOME Program participants are enrolled in a four-credit hour Calculus I course. As for professional development, the students attend mock Toastmasters meetings and several professional development workshops that are facilitated by corporate partners and university staff. This engagement helps students learn how to effectively network in a professional setting. In addition, participants are assigned to small teams and provided with a group project that is presented at the end of the program. The group project promotes teamwork, introductory research skills, and time-management skills. As for cross-cultural development, participants attend social outings and team building exercises such as a ropes course.

During the summer, upperclassmen serve as peer mentors and host evening sessions with the HOME Program participants to monitor their adjustment to college life. These individuals provide an invaluable student perspective on college life. This engagement allows the upperclassmen to play a key role in the social development of HOME Program participants. As such, the mentors are able to share strategies with the HOME Program participants for engaging diverse cultures on and off campus.

While the HOME Program begins in the summer, activities are also held throughout the academic year to maintain community of the cohort. This community of the incoming and current participants is achieved by assigning students to their respective departments for volunteering, hosting regular meetings, and ongoing social activities. In addition, focus groups are held at the end of each summer and throughout the academic year to obtain feedback from the current HOME participants for continuous improvement of the program.

GOALS OF THE HOME PROGRAM

The goals of the HOME Program are to provide support and integration into the college environment. Specifically, the goals of the HOME Program are to:

1. Recruit high achieving engineering and computer science students
2. Retain these high achieving engineering and computer science students

3. Provide participants with pre-college academic exposure, career preparation and networking opportunities
4. Provide structure and opportunities for a sense of community
5. Provide intellectual, personal/professional, cross-cultural development

The purpose of the HOME Program is to assist students in their intellectual, personal/professional, and cross-cultural development by providing seminars/workshops, mentoring, and coaching. During the summer, participants are enrolled in Calculus I and are required to attend supplemental instruction to assist them academically. Upon successful completion of the course, students receive four hours of college credit. In addition to the academics, HOME Program participants are assigned mentors to aid in their transition to college life.

CRITERIA FOR THE HOME PROGRAM

The HOME Program is sponsored by corporate partners of the COE. As such, corporate partners generally specify the desired GPA, majors and geographical residence of participants. HOME participants must be U.S. citizens with a minimum 3.3 cumulative grade point average. Students are selected to the HOME Program based on the following: competitive GPA, SAT/ACT score, intended major, and geographical residence in the country.

Admission into the HOME Program is attained by invitation only. HOME coordinators receive a list of students who have applied to the COE from the Office of Admissions. Students who have met the criteria referenced above receive information about HOME and a request to express interest in participating in the program. Those students that respond affirmatively are asked to participate in a telephone interview to be considered further. Based upon a successful telephone interview, an acceptance letter is sent to the student. Accepted students are notified no later than May 1st of each year.

Students admitted into the HOME Program typically have a minimum 1170 SAT (new math and verbal) or 23 ACT composite score while non-HOME Program participants typically have a minimum 1080 SAT (new math and verbal) or 21 ACT composite score. HOME Program participants are intended to enroll as full-time students during the fall semester in the College of Engineering. All students admitted into the HOME Program are enrolled in Calculus I during the summer and participate in extra-curricular activities. HOME Program students are placed in their initial math course based on their math SAT or ACT score. This math placement decision is true for all enrolled students during the summer or academic year. Further, the topics covered for the Calculus I course during the summer for HOME participants are the same as it is for others during the regular term. The total class hours during the summer are 52 hours as compared to 60-64 hours during the regular term. The delivery format is provided at a much faster pace during the summer (5-1/2 weeks) as compared to the normal 16 weeks of the regular term. HOME

Program participants are required to attend supplemental instruction four times per week in support of the Calculus course. If additional supplemental instruction sessions are needed, they are scheduled on the weekend.

DESIRED OUTCOMES FOR THE HOME PROGRAM

Students who are accepted into the HOME Program are considered as HOME scholars throughout their tenure. As such, the expectations for HOME scholars are clearly communicated to participants at the beginning of the summer session. HOME Scholars are expected to be successful academically, professionally and serve as role models for the rest of the COE student body. Often, former HOME students will serve as mentors during the summer sessions. Successful completion of the HOME Program coincides with graduation. HOME scholars are expected to:

- Graduate within four to five years with honors designation and,
- Serve in a leadership role in a COE student organization or student government association
- Receive a permanent job offer with one of the COE corporate partners or,
- Receive an acceptance letter to attend graduate school in engineering or computer science

BENEFITS OF THE HOME PROGRAM

The successful transition from high school to college is critical to the persistence of students. Implementing programs, such as HOME that assist with this transition allows students to be on the track towards graduation [2]. This assertion is evidenced by the high graduation rates of HOME Program participants. Students participating in the HOME Program receive several benefits. First, students are able to earn four college credit hours during the summer before enrolling in the fall semester. Second, students receive an opportunity to get acclimated to the campus environment prior to the fall semester. Third, students receive an opportunity to develop a network of friendships and learn key team building strategies prior to the beginning of the academic year and an opportunity to network with college of engineering faculty and staff. Fourth, HOME Program students work on developing and enhancing their study and time management skills and participate in seminars on career preparation topics such as interviewing skills, resume writing and communication skills.

COMPONENTS OF THE HOME PROGRAM

The HOME Program, a 5-1/2-week bridge program includes a rigorous schedule that include opportunities for intellectual, personal/professional, and cross-cultural perspective. From the first day on campus, HOME students are provided a weekly schedule in which they are required to follow. Participants are required to attend class daily and participate in all

program activities. This expectation quickly forces the students to begin their journey of being responsible and accountable. The components (Goal 3, 5) of the HOME Program include:

- New Student Orientation
- Personal/Professional Enrichment Workshops
- Four (4) Credit Hours of Coursework in Calculus I (based on Math SAT/ACT scores)
- Required Attendance at Supplemental Instruction
- College Readiness Workshops
- Field Trips to Regional Corporate Partner Sites
- Mock Toastmasters Meetings
- Team Project
- Social Activities
- Team-Building Exercises
- Free Time

TABLE I
TYPICAL HOME PROGRAM DAILY SCHEDULE

Mon	Tue	Wed	Thu	Fri
Class	Class	Class	Class	Class
Lunch	Corp. Lunch	Lunch	Corp. Lunch	Lunch
Workshop	Project	Workshop	Toastmasters	Corp. Tour
SI	SI	SI	SI	Free time
Dinner	Dinner	Dinner	Dinner	Dinner
Meeting	Meeting	Meeting	Meeting	Meeting
Free Time	Free Time	Free Time	Free Time	Free Time

Table I lists the typical schedule for HOME Program participants. As noted, the students are required to attend the Calculus I course each weekday and supplemental instruction four days of the week. Topics such as leadership, attitude, appropriate workplace attire, and professionalism are stressed during the summer and reinforced during the semester gatherings. Other professional development workshops, corporate sponsor luncheons and tours at local regional sites are also a part of the weekly schedule. The participants have scheduled daily meetings with the mentors. These meetings allow the HOME Program participants to share challenges and successes that they are experiencing during the program. The weekends are reserved for working on the team project, social development activities and free time. Ideally, the HOME Program is designed to model the activities of a typical semester.

RETENTION RATES

The retention and graduation of STEM students is critical if the nation is to continue its trajectory for providing a workforce that meets the demands of the global economy. Bridge programs that are designed to provide support and integration for incoming students have found to be successful in helping to graduate more minority students as compared to non-participants [1]. The authors believe that the early establishment of community and connection to the departments aid in retaining the HOME Program participants. STEM students are successful when they perceive that they are connected and have a sense of belonging [4]. During the summer, the student

mentors (upperclassmen) hold daily meetings with the students to provide and gather information on the group. Mentors are trained to assess if students are getting acclimated to college life and if they are making the necessary adjustments. In addition, during the summer experience, HOME Program staff hold a formal meeting individually with each of the participants to assess their level of connectedness and adjustment to college life.

The data in Table II indicates that participants in the HOME Program had higher first-year retention rates than those who were non-program participants. The data provided for the HOME Program students is maintained and updated each semester in a separate database. The data for the COE was retrieved from the fact book provided by the university's Office of Institutional Research. As for the HOME participants, out of the 189 students, only six have changed majors and 18 have not completed a degree in engineering or computer science.

TABLE II
1ST-YEAR RETENTION DATA (%)

Cohort	HOME	COE ^a
2012	100	85
2013	100	79
2014	93	80
2015	81	81.2

a – represents the average 1st-year retention rate of all nine engineering programs

The data in Table III indicates that the HOME Program participants outperformed the non-HOME Program participants as pertains to the 2nd-year retention rates. Retention rates ranged from 87.5% to 94.4% for HOME Program participants as compared to 56% to 57% for non-HOME Program participants. The COE data for 2014 was not available from the Office of Institutional Research.

TABLE III
2ND-YEAR RETENTION DATA (%)

Cohort	HOME	COE
2012	87.5	56
2013	94.4	57
2014 ^b	92.9	---

b – data was not available through the Office of Institutional Research

GRADUATION RATES

Because of the time span, only the four-year graduation rates were considered as a measurement. As such, the four-year graduation rates for the 2012 and 2013 cohort was 50% and 44% for HOME Program participants. The six-year graduation data within the major was 65% for HOME Program participants as compared to 40% for non-Program participants. Information was not available from the Office of Institutional Research for these cohorts in the College of Engineering.

However, a review of the previous years indicated a four-year graduation rate for STEM majors of less than 20%.

MEASUREMENTS

Several measurements were taken to support the goals of the program. Goals one and two are supported by data provided by the Office of Institutional Research and the Office of Admissions. Data on 1st and 2nd year retention are provided in Table II and III. Data on the measurement of academic performance for HOME Program participants and non-HOME Program participants is provided in Table IV. Futuristically, all recruitment, retention, and academic performance data should be provided by the OIR. Goal three includes activities that support the student's personal and professional development. Future measurements should include data to measure the student's self-efficacy. No measurements were taken to assess Goal four. However, future measurements should include the level of engagement for members in the community. No measurements were taken to assess the personal, professional, and cross-cultural workshops offered in Goal five. Measurements for Goal five could include pre-surveys and post surveys for knowledge level regarding the various workshop topics.

RESULTS

While there is conflicting data on the significance of summer bridge programs such as HOME [3]-[5]-[6]; since the inception of this program, HOME Program participants have performed at a higher rate academically than non-HOME Program participants. For example, as incoming freshmen, HOME Program participants have an average weighted high school GPA of 3.9 (Goal 1) as compared to 3.7 for non-HOME Program participants. Similarly, HOME Program participants have an average first-year retention rate of 90% (Goal 2) as compared to 81% for non-HOME Program participants.

Many HOME Program participants assume leadership roles in COE student organizations and the student government association and are nominated for various awards. For example, several HOME Program participants have been nominated for the Namaskar Award, the highest award for COE undergraduates, several participants have won the Black Engineer of the Year Award, have the designation as a Grand Challenge Engineer, and secured prizes from participating in the COEs annual internship competition. A number of the participants have completed master's degree programs and some have begun Ph.D. programs. In addition, two of the HOME Program participants have served as Mister & Miss NCA&T. One participant developed a patent while working on a summer internship. A number of the program students have participated in undergraduate research, and have studied abroad. While students in the COE assume leadership roles in various student organizations, the authors believe that based on anecdotal information that a high percentage of the HOME students aspire to leadership roles. This assertion is based on the assumption that previous HOME participants

provide inspiration through their accomplishments. Nonetheless, the authors recognize the need for quantitative data on students assuming leadership roles, awards received, employment, and enrollment in graduate programs.

The data in Table IV provided by the Office of Undergraduate Admissions represents the cumulative grade point average for HOME Program Participants and non-Program participants at the end of the spring semester each year from spring 2013 to spring 2017. To avoid duplication, the data for the non-HOME Program students does not include the data for HOME Program students. This data indicates that the HOME Program participants have consistently outperformed the non-Program participants when it comes to academic performance. The cumulative GPA for HOME Program students ranges from 3.03 to 3.53 while the cumulative GPA for non-HOME Program participants range from 2.5 to 3.1. While the average high school weighted GPA was only a difference of 0.2 points for the two groups, the HOME Program students outperformed the non-HOME Program students significantly. The early successes gained in successfully passing the Calculus I course during the summer provides a foundation for future success [7]. The authors believe that this early success helps to improve the self-efficacy of the HOME Program students. The authors recognize the need to collect data that measures self-efficacy for the HOME Program students.

TABLE IV
ACADEMIC PERFORMANCE (GPA)

Co-hort	Academic Year							
	2013-14		2014-15		2015-16		2016-17	
	H	C	H	C	H	C	H	C
2013	3.53	2.44	3.4	2.94	3.31	2.97	3.2	3.1
2014			3.18	2.45	3.23	2.88	3.24	2.94
2015					3.09	2.33	3.07	2.93
2016							3.03	2.23

H = HOME
C = COE

Several of the major distinctive points for the HOME Program include the early establishment of community among the students and the accountability during the academic year. The concept of community (Goal 4) is established during the summer and carries over into the academic year. During the academic year, HOME Program students participate in monthly gatherings in where they participate in various professional development workshops. HOME Program students begin to develop relationships with like-minded individuals and these relationships are often maintained throughout the four or five years as undergraduates. Some of these relationships are maintained even after graduation. Accountability includes attending semester gatherings along with volunteering at least five hours per week with the respective department or the COE dean's office. The volunteerism allows the HOME student to quickly get attached to the department faculty and staff and thus the student is more

likely to share academic or personal challenges in order to receive assistance. Additionally, this early connection allows the student to quickly learn how to navigate for success. It would be helpful to gather data during the senior exit survey for HOME students on the impact of community on student's success.

RESEARCH LIMITATIONS

The research presented in this paper is in the preliminary stages. This groundwork approach allows the authors to build upon opportunity for future advancement with the information presented. While collecting the data, there were several opportunities for advancement in future research. The information gathered for academic performance and retention were retrieved from the Office of Admissions and not the Office of Institutional Research. In the future, this information should be obtained from the Office of Institutional Research, however, because of the availability of data at the time of publication the former was reported.

The authors realize that the students that participate in the HOME program are not like participants in many summer bridge program in need of remediation and underprepared for college [8]-[9]. While the high school GPA of both groups were within 0.2, the authors propose future research should compare groups with the same weighted average GPAs. Additional data is needed that would track self-efficacy of HOME students as compared to all COE students. One of the many benefits of students participating in a summer bridge program include an increase in self-confidence [10]. The increase in self-efficacy would prove to be valuable to the engineering community. In other words, in order to substantiate the validity of the results, a sampling of students should be formed that closely match the entry characteristics of HOME participants for comparative analysis. In addition, most of the survey information and feedback is self-reported. The authors also recognize the need to identify and use validated instruments or use measures to validate the instruments that are used. Similarly, a formal assessment of the program is needed at regular intervals to ensure continuous improvement.

As for research methods, most of the data gathered was qualitative with some simple quantitative data. For further research, the authors propose that a longitudinal study be done to validate the findings and to learn how minority students persist in pursuing an engineering or computer science degree. As for data collected on leadership roles, awards received, employment, and enrollment in graduate programs, the authors propose that a unique senior exit survey be implemented. In addition, because of the manageable size of students in the HOME Program, data could also be collected on an annual basis pertaining to leadership roles and accolades received. Data should also be collected that measures the impact of community on the HOME Program student's success.

CONCLUSIONS

The authors conclude that elements provided within the HOME Program provide a significant impact on the success

of the participants. The elements of connectedness, establishment of community, and accountability seem to aid in academic performance and first-year retention of the HOME Program students as compared to non-participants. The connectedness and establishment of community begin during the summer and carry over into the academic year. These successes allow the students to focus more on their studies and hence, become academically successful. In addition, the connectedness and community allow the HOME Program students to navigate the rigors of academia successfully. The HOME Program staff works to achieve student connectedness by requiring students to volunteer five hours per week in a department within the college. This requirement allows the students to connect with the department faculty and staff. The establishment of community is demonstrated by the students having monthly gatherings in which all HOME students attend. In addition, HOME Program students meet regularly with program staff to ensure that students are getting connected and adjusted to the culture. Graduating HOME students confirm that the connectedness and sense of community is one of the factors for their success.

Perhaps a formalized evaluation process would prove helpful to the HOME Program in order to identify and track key success metrics. Future study should also include the success of underrepresented female STEM students who participated in the HOME Program as compared to non-participants. With a 30% female population in the COE, such a study may prove helpful. Finally, a look at how the elements of the HOME Program inspire participants to assume leadership roles in discipline student organizations or student government associations would also prove helpful for the literature.

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