# 2006-1743: DEVELOPMENT OF AN ACADEMIC PROGRAM THAT INCREASES MULTI-ETHNIC STUDENT RETENTION IN ENGINEERING

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# Development of an Academic Camp That Increases Multi-Ethnic Student Retention in Engineering

**Abstract-** To ease admitted pre-college engineering students' transition to college at Purdue University, the Minority Engineering Programs Office (MEP) of Purdue University created a five-week on-campus academic summer program: The Academic Boot Camp, that enrolled its first class of students in June 2005. Within this program, twenty-four multi-ethnic students attended first-year level Calculus, Chemistry, English, Introductory Engineering and Design courses. Four staff members, three counselors, six instructors and two supplemental instructors supervised students during the five weeks and helped them become familiar with the culture of the university and of the local community. In addition to attending academic classes, students attended several off-campus venues that related to the fields of science, technology, engineering, or mathematics. The program concluded with a semi-formal student reception and with a closing ceremony in which students received awards. Parents, university administrators, faculty, and students celebrated the success of the camp at the closing ceremony. This paper discusses the development of the program, suggestions for enhancing the program and ways to assess the program's effectiveness.

## Introduction

A study conducted by the Accreditation Board for Engineering and Technology (ABET) and funded by the Exxon Education Foundation[1] attempted to answer the question of whether or not, upon graduation, student achievement in engineering reasonably correlated with students' qualifications at their point of entry into college. According to the study, the mean GPAs for African-American (2.15), Hispanic (2.39), and non-minority (white) (2.67) engineering graduates were compared. The results were alarming. For non minority (white) students, 45% entered with a B+ average, and 33% graduated with a B+ average. For Hispanic students, the numbers were 46% and 18%, respectively. For African-American students, however, the numbers were significantly different. Thirty-seven percent of African-American students entered with a B+ average, but only 5% graduated with a B+ Average.

In response to decreases in academic achievement for many minority students within engineering undergraduate programs over time, several colleges have implemented "bridge programs," which have been used to improve high school to college transition of students, especially those in underrepresented groups and those who may have attended high school programs that lacked academic rigor.[2,3,4] In addition to helping students succeed academically, these programs have the potential to provide positive environmental and social climates that can play significant roles in building students' senses of 'belonging'.

Although summer bridge programs have existed for over two decades, one program that has served as a model for the program described within this paper is the Georgia Institute of Technology's Challenge Program, which introduces first-year mathematics and science minority students to the rigors of college life.[4] Over several years, the Challenge Program has shown strong upward trends of academic achievement for students who participate in the program compared to those who do not participate.

The Purdue University Minority Engineering Program looked at the Challenge Program as a benchmark to see what elements could be useful for the development of a summer bridge program at Purdue University. There were two areas of major concern that had to be addressed differently for the challenges faced at Purdue: 1) the rich cultural social climate in Atlanta, Georgia did not have the same challenges for potential students who might consider the corn fields of West Lafayette, Indiana, 2) the Challenge Program was not specifically for pre-college multi-ethnic engineering students, which was the core focus of the Purdue Model. The Purdue model also utilized the Guaranteed 4.0 Learning System[5] approach developed by Donna O. Johnson as a core foundation for learning. Both the student and their parents were exposed to the Guaranteed 4.0 Learning System prior to the students beginning the Boot Camp studies. This paper discusses the development of the program, the lessons learned from the program, suggestions for enhancing the program and ways to assess the program's effectiveness.

## Development of the Academic Boot Camp

To ease admitted pre-college engineering students' transitions to college at Purdue University, the Minority Engineering Programs office of Purdue University created a five-week on-campus academic summer program that enrolled its first class of students in June 2005. This bridge program or Academic Boot Camp (ABC) focused on the first semester of an engineering student's college experience. It exposed twenty-four multi-ethnic students to the environmental climate of West Lafayette, Indiana, coursework for first year engineering students and the pace of college life (compared to high school). Environmental climate components of the Boot Camp included students' living in the dormitories with floor counselors, living in an environment responsibly without parental reinforcement, visiting community landmarks to become familiar with the city of West Lafayette and team building exercises off-campus. In addition, students participated in cultural activities and social events. University and corporate sponsors for the 2005 Academic Boot Camp included the Louis Stokes Alliance for Minority Participation (LSAMP Indiana), the Indiana Space Grant Consortium, Purdue's Civil Engineering Department, Purdue's College of Engineering, Lockheed Martin, General Motors, DaimlerChrysler, Delphi and Donna O. Johnson from the Guaranteed 4.0 Learning Systems, LLC.

### *Criteria for Admission to and Employment within the Program*

Twenty-four students were accepted to the first Boot Camp (Alpha class 2005). To become a member of the Alpha class of the Boot Camp, students met several criteria. Students must have been admitted to Purdue with intentions to attend the University. In addition, students were required to attend the entire five-week program. Students that had participated in at least one of the Minority Engineering Program's pre-college pipeline programs were targeted.

Four staff members, three counselors, six instructors and two supplemental instructors supervised students during the five weeks and helped them become familiar with the culture of the university and of the local community. Boot Camp instructors had to meet the following criteria: in-depth knowledge of course content and material, competency in instruction as demonstrated in mock lectures, previous exposure as a teaching assistant for the courses taught during the Camp, enthusiasm in teaching, availability for total participation during the entire

program and an understanding of and belief in the need of the Boot Camp. Counselors were expected to have previous experience in dormitory counseling, a valid driver's license, availability for length of the program and an interest in Minority Engineering Programs. Previous experience and exposure to undergraduate engineering curriculum was desired.

*Academic and Extracurricular Components of the Program*

The Academic components of the Boot Camp included four first-year engineering courses and a five-week team based engineering project designed to expose students to the pace of learning at Purdue. Courses included Plane Analytic Geometry and Calculus I (MA 161), General Chemistry (CHM 115), Engineering Problems Solving and Computer Tools (ENGR 106) and First Year Composition (ENGL 106). The courses were not offered for credit toward graduation but exposed students to the dynamics of time management, study skills, test taking skills and teacher/professor relationship building to maximize subject mastery.

Various extracurricular activities were implemented into the program in order to give the students a well-rounded experience. Since Purdue University is located approximately 65 miles northwest of Indianapolis and approximately 120 miles southeast of Chicago, students were able to visit multiple venues. Activities included the following:

- A tour of the Space Challenger Learning Center in Brownsburg, Indiana
- "Day on Campus" orientation program for new students in conjunction with the First-Year Engineering Program
- Activity night (Movies, games, socials, etc.)
- Life studies sessions
- An Independence Day Cookout
- A Chicago White Sox Baseball Game
- A visit to Museum of Science & Industry in Chicago, IL
- A tour of the Delphi Automotive Systems plant in Kokomo, IN
- A "Guaranteed 4. 0 Workshop" presented by Donna O. Johnson

Assessing the Effectiveness of the Academic Boot Camp

To date, the effects of many programs devoted to increasing the numbers of minorities who succeed in science and engineering have not been assessed formally.[4] Preliminary results from the Academic Boot Camp show that the first semester average GPAs for multi-ethnic Academic Boot Camp participants was significantly higher than multi-ethnic peers who did not participate in the Boot Camp. During the first year of the program, pre-test and post-test data for the courses were collected as well as an assessment of course components that students found to be beneficial and enjoyable. In the future, engineering education faculty will work closely with the Minority Engineering Program staff to analyze Alpha Class data and to develop longitudinal assessments that will track program participants' achievement and retention within engineering at Purdue. Results from current assessments will be used to improve aspects of the program.

Future Directions

In an effort to enhance the Academic Boot Camp in the future, program developers are interested in increasing the number of academic topics covered within the Camp. The hope is to expand the Boot Camp to include separate tracks for science, technology and mathematics students. The plan also includes the involvement of high school instructors working with college-level instructors in aspects of the Camp and giving Camp participants academic credit for content that is covered during the program. Additional information about these initiatives is located in Table 1.

| **Proposed Initiative** | **Description of Initiative** |
|---|---|
| Three Semester Coverage of Academic Content | Addition of a sophomore-level component with emphasis on courses that have historically been difficult for sophomore engineering students at Purdue. |
| High School Teacher/College Teacher Partnership | Future Boot Camp content will offer significant opportunities to invite high school chemistry and calculus teachers to participate in Boot Camp activities. They will assist in developing course-work material as well as learn first-hand the academic expectations of first-year students. |
| Expansion of the Academic Boot Camp to other STEM Disciplines | Addition of separate 'tracks' for students interested in other STEM disciplines with opportunities for collaboration with multi-ethnic students across disciplines. |
| Potential Course Credit | Future opportunity to offer course credit to students who successfully complete courses offered during the five week (or longer) program |

Table 1- Future Initiatives within the Academic Boot Camp

Conclusions

Although the 2005 Academic Boot Camp has produced students who, on average, performed higher academically than their first-year multi-ethnic counterparts, additional improvements to the program are being made. First, current data are being analyzed, and new assessments for the program are being developed. Second, partnerships with faculty within professional engineering schools and within science, technology and mathematics departments are being formed in an effort to increase the access of multi-ethnic students to resources they will need prior to their matriculation at Purdue. Finally, the program is being expanded to include additional resources for students and for others who might benefit from working within the Academic Boot Camp.

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