

Recruitment of Women and Minorities into Engineering Technology Programs

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Abstract

The paper describes an experimental summer program "Access To Careers In Engineering" (ACE). The program was a recruitment strategy which targeted under-represented groups and sought to motivate them toward careers in engineering and engineering related fields. The ACE program was offered August 7-11, 1995. This program provided exposure to careers in engineering, engineering technology, and mathematics to 10th and 11th grade female and minority students. The goal of the program was to create an interactive environment which allowed the high school students to participate in hands-on activities related to engineering, engineering technology and mathematics. The objective of these activities was to increase self-esteem of the participants through the completion of various projects and promote an awareness of career opportunities in these fields. The ACE Program was founded through a grant from The Pennsylvania State University-College of Engineering Enhancement Fund and Equal Opportunity Planning Committee. The paper also discusses the effectiveness of the program from the perspective of the high school students and the Penn State faculty who were involved in the program.

Introduction

The participation of women and minorities in engineering, engineering technology, mathematics, and related careers continues to be an issue for discussion. Defining the personnel resources for new engineers leads many academic institutions to evaluate the role of women and minorities in the engineering and technology fields. Figures from the Bureau of Census (1994 Ed.) indicate that 8.6% of employed engineers are women, 3.7% are Black, and 3.6% are Hispanic.¹ Further independent studies indicate that although female enrollment in engineering programs climbed between 1973 to 1982, it peaked in 1983, and declined in 1986. For that same time, figures for Blacks indicated that the 2% figure in 1984 has not risen significantly.² In response to these figures and projected needs, The Pennsylvania State University - Hazleton Campus developed the "Access to Careers in Engineering" Program (ACE). ACE was designed to be a co-operative program which brought 10th and 11th grade female and minority students in contact with Penn State faculty from the Engineering, Engineering Technology, Mathematics, English, Guidance, and Physical Education Department, and local industry. This paper describes the development, operation, and conclusions derived from the ACE Program.



Needs Assessment

The Penn State faculty had noticed that in recent years there were only a few female and minority students who had applied for admission to engineering, engineering technology, and mathematics programs. Over the years numerous recruitment strategies had been ineffective in bringing these under-represented groups to the campus. In developing the ACE Program, the Penn State faculty targeted 10th and 11th grade female and minority students. The Penn State faculty was working on the assumption that these students' experiences in the ACE Program would motivate them toward careers in engineering and mathematics. These students would be choosing higher education opportunities within two years. It was felt that the experiences from the ACE Program would be a significant influence in this decision-making process. Therefore, these students would be the most beneficial target population.

Recruitment

Candidates for the ACE Program were asked to complete a one page application and write an essay explaining why they were interested in participating in the program. The applications were made available to school districts within a 25 mile radius of the Penn State - Hazleton Campus. The Guidance Departments of the local school districts facilitated the dissemination of the applications, The Penn State committee selected 30 students to participate in the program based upon their essay with preference given to the potential first generation college students.

Program

The ACE Program was designed to provide students with hands-on experiences in engineering and technology related fields. During the week long program at The Pennsylvania State University - Hazleton Campus, each student participated in the following workshops:

Electrical Engineering Technology Lab (6 hours)

The students became familiar with the frequency-selective circuit known as a filter. Various types of filters were discussed. They also performed circuit analysis using PSPICE. The students used the computer-aided software, ORCAD, to draw electrical/electronic schematics,

Mechanical Engineering Technology Lab (3 hours)

Students were introduced to the concepts of Computer Aided Design and Computer Aided Manufacturing. Each student designed a simple machine part using the hands-on computer lab.

Mathematics Lab (3hours)

This workshop provided an awareness of career opportunities in mathematics as well as the importance of mathematics in engineering and science. In relating mathematics to the real world, students were challenged to derive algebraically the horizontal distance of volcanic fallout. Students completed a BASIC program which computed the velocity and vertical and horizontal distances for nine layers of the atmosphere. Students then graphed the input and output information to trace the path of the volcanic fallout.



In addition to the hands-on technical experience the ACE participants were exposed to a variety of topics related to career choices in engineering and mathematics, These included:

Career Decision Making(1 hour)

The students were introduced to a systematic approach to making decisions and planning a career. These included self-assessment, information gathering, and preparation.

Health Education (1hour)

The students discussed the challenge of multiple roles in their lives (i.e. there is an expectation that we will successfully master the ability to fulfill a variety of roles). The participants identified these anticipated roles, became aware of the challenges that they may present, and considered effective approaches.

Math Anxiety (1 hour)

The students in co-operation with the presenter assessed their feelings about math and the level of math anxiety within individual members of the group. Techniques were discussed to reduce math anxiety, create effective study strategies for math, prepare for math tests, and ways to get maximum results on math tests.

Technical Communication (1 hour)

The students were introduced to the steps and criteria for preparing effective technical reports and for writing a resume, and letter of introduction for an application or interview.

Recreational Activities (6 hours)

The students participated in line dancing and swimming, They became aware of the need to participate in recreational activities in order to provide a balance in their life.

Educational Field Trip(7 hours)

A one day field trip was taken to Procter & Gamble. This trip enabled the students to see the transfer of their classroom activities to practical industrial applications.

The students who participate in this 29 hour program attended a one day follow-up workshop during the fall. These on-going hands-on experiences provided during the summer and fall programs helped to maintain the motivation, interest, and self-esteem of the students while they were preparing to make their career decisions.

Conclusions

At the end of the ACE Program, each student completed an evaluation survey. 100% of the participants stated that the ACE Program provided them with information about careers in engineering, engineering technology, mathematics and the requirements for those careers. 79% of the participants stated this program helped instill self-esteem and encouraged them to pursue their interests in engineering or mathematics.

Overall, the student reaction was positive and the participants indicated they would participate in the follow-up workshops. When rating the most beneficial components of the program, the students responded favorably to the ACE program providing new information about various careers in engineering and



mathematics, the field trip to Procter and Gamble plant, and the opportunity to ask questions. They expressed the need for more computer application and details about certain careers (such as Aerospace and Chemical Engineering).

As result of their participation in the ACE program, 58% of the participants indicated they were considering a career in engineering, engineering technology, or mathematics.

References

1. U.S. Statistical Abstracts, National Data Book. U.S. Department of Commerce. Bureau of Census, 1994 Edition
2. "Declining Female Enrollments Threaten Gains of Early 1980's", Aviation Week & Space Technology, December 5, 1988, p. 41.

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