

## **FRESHMEN P.O.W.E.R.**

Dorie McCubbrey, Ph.D. and Mary C. Verstraete, Ph.D.

The University of Akron, Akron, Ohio

### **BACKGROUND**

One of the goals of the Women in Engineering Program at The University of Akron is to increase the number of engineering bachelor's degrees awarded to women by improving student retention. Estimates of retention rates revealed the greatest loss of female students was between the freshmen and sophomore years. This attrition is attributed to: a lack of adequate scholastic preparation, difficulty in making the transition from high school to college, a lack of strong motivation to earn an engineering degree, and difficulty handling the "chilly classroom climate" in engineering. To address these problems The University of Akron has developed an orientation for first-year women engineering students. This program, entitled Freshmen P.O.W.E.R. (Preview Of Women Engineers Retreat), was held for the first time in August 1995. The goal of the retreat was to provide these students with experiences to aid in the successful completion of their engineering degrees.

### **PROCEDURES**

#### **General Information and Opening Activities**

The half-day retreat was held on a weekend day before the start of the fall semester. An off-campus location was selected to provide students with a more relaxing environment. All incoming female freshmen were invited to the retreat. Thirteen students attended, out of a total of 26 new women in engineering. The retreat began at 9:00 a.m. and concluded at 4:00 p.m. Several of the day's activities were adapted from a retreat held at The University of California at Davis<sup>1</sup>, with new activities also created. The major program cost was for refreshments. Upon arrival, students completed an incoming survey, which assessed their knowledge about the different engineering disciplines and college life. The program then began with an ice breaker activity called "Human Bingo" which involved students obtaining background information about each other to complete a Bingo board.

#### **Transition Seminars**

Three seminars were featured to assist students in making the transition from high school to college and to help them achieve scholastic success. In the first seminar, students were informed on how they could take advantage of campus services and activities, such as tutoring. Special focus was placed on developing good study habits and becoming involved in engineering student societies. The second seminar prepared students for the "chilly classroom climate", through a discussion of a video on gender bias<sup>2</sup>. Students were informed on how to properly handle any gender bias that they might encounter. The third seminar showed students how to develop an assertive communication style.

## **Hands-On Activities**

Activities were designed to cover hands-on applications in the four engineering disciplines offered as undergraduate majors at The University of Akron. The purpose of these hands-on activities was to expose the students to engineering terminology and to familiarize them with some of the problems that an engineer might address. The overall goal was to provide motivation to succeed in their pursuit of an engineering degree. Women engineering professors and students were recruited to demonstrate the different activities.

### Mechanical Engineering

Teams of students were asked to design a system to help prevent the driver of a car from hitting the back wall of the garage when parking. This activity familiarized students with the process of brainstorming, and also illustrated that a variety of designs could solve the same problem. Following this activity, new teams were formed and each team was given a device with mechanical parts (i.e., cassette player, typewriter, doorknob) and a variety of hand tools to disassemble the device. This familiarized the students with different tools and to allowed them to understand how mechanical components operate.

### Civil Engineering

Students were led through calculations of material stress, strain, and modulus of elasticity. To illustrate these concepts, each student was then given two pieces of chalk and instructed to break one piece in bending and one piece in torsion. This exposed students to terminology used in discussion of strength of materials and helped them visualize the concepts they discussed. Students then worked in teams to calculate the deflection of a "bridge" (a yardstick simply supported by soup cans). This activity showed students how to make structural measurements and calculations and enhanced their teamwork abilities.

### Electrical Engineering

Students learned the basic concepts of Ohm's Law, first by seeing circuit diagrams drawn on the board, and then through experimental validation. Students worked in pairs to construct two different circuits and to measure the resulting current. This illustrated electrical engineering concepts and showed students how to verify the concepts experimentally. A second activity involved a demonstration of electromagnetic fields through a "homemade motor" to illustrate some additional electrical engineering concepts.

### Chemical Engineering

A demonstration of particle separation was provided for the students to familiarize them with concepts in chemical engineering. Different "filters" were used to separate different sized "particles." A second activity required the students to work in teams to solve an environmental engineering problem. Each team was to make a recommendation of how to contain a toxic spill using one or more different types of sealants. This illustrated the application of chemical engineering concepts to an environmental problem.

## **Closing Activities and Follow-Up**

Students completed a post-program survey to assess their perception of how much they learned. In the final activity, the students worked together to untangle a "Human Knot" showing them "by working together, you can unravel any problem." As a follow-up, students were encouraged to meet with the Director of the Women in Engineering Program for any assistance. Students were also encouraged to attend meetings of the Society of Women Engineers. To assess the short-term effects of the orientation, the pre- and post-program surveys were reviewed. The long-term effects were assessed by comparing the grade point averages of the students who attended the orientation with those who did not.

## RESULTS

### Short-term findings

The surveys indicated that the participants increased their level of understanding of the different engineering disciplines, increased their knowledge of campus life and increased their confidence level in themselves. All students indicated that their understanding increased either "to some extent" or "very much." All students indicated that the orientation met their expectations "very much." Some of the comments included: "the hands-on experience was most valuable", "this helped me see some problems that I might encounter in a future job", "learning about communicating assertively was helpful", "the program was very informative, helpful, and fun". Some suggestions for future orientations were: "include some aspects of computer use", "involve more students to illustrate the concepts", "more hands-on experience!".

### Long-term findings

There were a total of 26 new first-year female students with a declared major in engineering. By the end of the Spring 1996 semester, 2 of these students had disenrolled and 4 students had changed majors. This resulted in a total of 20 female engineering students remaining after two semesters (76.9% all first-year female students retained). Of the 13 students who attended the Freshmen P.O.W.E.R. program, 2 disenrolled or changed majors. This resulted in a total of 11 students remaining from the orientation program after two semesters (84.6% orientation students retained). The median GPA for the 11 remaining P.O.W.E.R. students was 3.141, which was significantly higher than the median GPA of 2.902 for the other 9 remaining students who did not attend the orientation (median test,  $p=0.035$ ).

## CONCLUSIONS AND FUTURE DIRECTIONS

The short-term effects of the orientation were very positive. The participants developed a camaraderie, and also left the program with increased knowledge and increased self-confidence. The students became well acquainted with the Women in Engineering Program and the Society of Women Engineers, which may facilitate their use of these resources for ongoing support. The long-term effects (two-semester post-orientation) are also positive, yet somewhat inconclusive. The students who attended the Freshmen P.O.W.E.R. orientation program had a higher median GPA as compared to the median GPA for those who did not attend the orientation. This may indicate that the orientation helped students achieve scholastic success; however, the possibility remains that the students who attended the orientation were simply "better students" in the first place. Although the specific benefits of the orientation program are difficult to quantify, we believe that the program is an excellent way to help students make the transition from high school into college, and our initial results suggest that this type of orientation program may help improve retention during the freshmen year. We intend to feature a similar orientation for the female engineering students who will begin their studies in the Fall of 1996.

## REFERENCES AND CITATIONS

1. Mack, Karin L. "Community Building First-Year Student Retreat." WEPAN 1995 Conference Proceedings, pp. 271-274.
2. "Equity in Education: Gender Bias in the College Classroom," © The Regents of the University of California.



