KEYS to Empowering Youth: Cross-Institutional Collaboration in Engineering Outreach for 11-13 Year-old Girls

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Introduction and Rationale

Women continue to be underrepresented at virtually every point in the science and engineering pipeline — including the undergraduate, graduate, and professional levels. Factors leading to women's underrepresentation may begin long before high school and college, particularly resulting from experiences during early childhood and adolescence. In examining critical factors behind women's continued underrepresentation in non-traditional fields such as science and engineering, Blaisdell (1995) cited variables such as self-efficacy, sex role stereotyping, lack of female role models, and the perception that engineering and the sciences are "masculine" fields. In educational experiences as early as the elementary level, research has indicated that teachers tend to call on male students more frequently and push them harder to succeed academically (AAUW, 1992). These and other determinants may serve to strongly influence the likelihood that women will continue to choose non-traditional career paths in small numbers, although they are strongly capable of excelling in these fields.

In working to begin counteracting such trends at the local level, the Society of Women Engineers (SWE) student chapters at the Catholic University of America, Howard University, and the University of Maryland at College Park (UMCP) sponsored the KEYs to Empowering Youth Program, a series of one-day science, technology, and engineering workshops targeted toward 11-13 year-old girls. This particular age group was chosen since the middle school years appear to be crucial ones in encouraging girls to pursue their talents and interests; supporting them not to succumb to negative peer pressure that dissuades them to go into math, science, or engineering; and tracking them into math and science courses in high school, thereby preparing them both emotionally and academically to pursue engineering at the college level. Thus, the underlying premise behind KEYs was to expose participants to positive female role models, enhance their self-confidence and increase their self-esteem, provide them the chance to meet other girls their age with similar interests, and unveil exciting opportunities for potential

educational and career paths in science and engineering.

History of KEYs

In 1993, a committed group of students, faculty, and staff at the Massachusetts Institute of Technology (MIT) began the KEYs to Empowering Youth Program to address the needs of girls in the local community. These ECSEL-sponsored programs were organized as either one-day or three-day programs in which 11-13 year-old girls came to MIT's campus and were mentored by female students; participated in hands-on activities to spark their interest in science, engineering, and technological fields; and gained exposure to educational and career opportunities. When Dr. Corinna Lathan, one of the founders of the KEYs Program, began as Assistant Professor of Biomedical Engineering at Catholic University, she contacted Howard University and UMCP about the possibility of collaboratively implementing KEYs Programs on each of the campuses.

Goals and Objectives for UMCP's Program

The KEYs Planning Committee at UMCP involved members from the UMCP chapter of SWE, graduate assistants working with the Women in Engineering (WIE) Program, and others students involved in WIE programs and initiatives. Their first meetings were spent discussing their goals, objectives, and vision for the one-day program. In planning and structuring the activities for the day, the committee had the following goals in mind: (1) to empower young girls to become excited about learning and to see themselves as leaders, capable of anything and everything; (2) to expose these girls to science and engineering through hands-on, interactive labs and to ignite their imaginations; and (3) to provide the girls with mentors and a network of resources to feel part of a larger, supportive community.

Cross-Institutional Collaboration

The SWE Chapters of Catholic, Howard, and UMCP, all of which are located in the Washington, D.C. metropolitan area, worked jointly in planning the structure of the programs, sharing training materials, serving as mentors at each of the programs, and recruiting 11-13 year-old girls. A majority of the recruiting efforts were conducted through institutional and K-12 e-mail distribution lists as well as outreach to local inner-city community groups. While Catholic held one-day programs during Spring 1996, Fall 1996, and Spring 1997, UMCP and Howard held programs in Spring 1997. Having KEYs Programs on four different dates and at varied locations not only provided participants greater flexibility in choosing which program to attend, but the collaborative aspects of the program also gave the college mentors involved the opportunity to network with each other and share ideas and experiences.

Role of College Student Mentors

The mentors were essential to the program's ultimate success because they not only helped plan the day, coordinate labs, and facilitate activities with the girls, but they also served as role models for women in engineering. In addition, these women were viewed as the "new stereotype" that KEYs is trying to create of women in engineering. UMCP's mentors were recruited through SWE, WIE, and the University Honors Program e-mail lists. Approximately two months before the program, a training session was held, including an overview of the program, what it means to be a mentor, and how to work with the 11-13 year-old age group.

Program Structure and Itinerary for the Day

UMCP's KEYs Program was based on the original structure for one-day KEYs Programs provided by MIT. The morning session was dedicated to empowerment and self-confidence building through leadership development, self-defense training, team building, and small-group mentoring activities. The leadership development portion of the program was presented by Patricia Eng, PE, of the Nuclear Regulatory Commission, also an expert on women in science and technology. The self-defense presentation was conducted by Lieutenant John Brandt of the UMCP Campus Police, who facilitated an interactive workshop about safety, awareness, and self-defense. The afternoon activities included rotation through four hands-on science and engineering labs, including Acid Rain/Thin Layer Chromatography, Buoyant Forces (Sava River Pontoon Bridge Lab), Drag Force (Parachutes), and finally, World Wide Web Exploration. These labs were designed to be interactive and fun, with a particular emphasis placed on real-world application to the girls and their life experiences. At the end of the day, parents, families, and guardians were invited to attend an awards ceremony, in which all the girls were recognized for their participation. Twenty-four girls attended UMCP's one-day program.

Evaluation of UMCP's KEYs Program

In an effort to evaluate the effectiveness of UMCP's KEYs Program in meeting its stated goals of "empowering young women by promoting self-confidence, increasing their self-esteem, and unveiling opportunities for potential career paths," a two-page survey was administered at the end of the day to all 24 participants. This survey included both qualitative and quantitative questions. Based on the responses to the survey, it appears that the KEYs Program was an overwhelming success!

Programs and Labs

When participants were asked what their favorite part of the KEYs Program was, a majority responded "exploring the World Wide Web." Other responses to this question included:

"The beginning of the program and when the mentors and mentees got together and did little projects."

"The labs were my favorite part."

"I liked building things out of genuine materials."

"Everything. I would like to come back so I can have another experience. I have learned more about science than ever."

When asked what their least favorite part of the KEYs Program was, almost half of the participants (46%) responded "nothing" or "I liked it all." In responding to this question, one participant summarized her experience . . . *"In fact you should have it at the University of Maryland again and again. It is so much fun."* Participants were also asked for suggestions on how to improve the KEYs Program. Over one-fifth (21%) suggested that the KEYs Program be developed into a summer camp for girls. Other suggestions included adding more labs and increasing the amount of time available to talk to their mentors about engineering.

The World Wide Web Exploration Lab appeared to be the most popular lab based on the survey responses. Almost 80% of the participants indicated that this lab was their favorite, followed by the Acid Rain Experiment. When asked what their least favorite lab was, 67% of the participants responded "none."

Of the four programs that took place during the morning, 71% of the participants indicated that the Self-defense and Self-assertiveness Training was their favorite, followed by small group activities with their mentors (29%). When asked what their least favorite program was, 84% responded "none."

Promoting Self-confidence and Unveiling Opportunities for Potential Career Paths

Participants were asked to respond to a number of questions based on a five-point Likert scale from 1 ("strongly agree") to 5 ("strongly disagree"). When asked whether the program had increased their interest in science, math, and engineering, the mean response was 1.67, and the standard deviation was .86. When asked whether the program had increased their confidence in science, math, and engineering, the mean response was 1.71, and the standard deviation was .75. And finally, when asked if the program had increased their knowledge about educational and career opportunities, the mean response was 1.33, and the standard deviation, .64. Based on these findings, it appears that the program successfully met its goals of promoting self-confidence, providing positive experiences for learning about science and technology, and presenting information about educational and career opportunities in science, math, and engineering.

Women Engineering Students as Role Models

Another objective of the program was to provide the participants with women role models and a positive mentoring experience so that they could begin to move beyond the stereotypes that have traditionally overshadowed the scientific and technological fields. The participants were asked to respond to the following statement based on a five-point Likert scale from 1 ("strongly agree") to 5 ("strongly disagree"), "I feel that the college students we worked with are positive role models for girls interested in science, engineering, and math." The mean response was 1.25 and the standard deviation, .61. The participants were also asked to respond to the statement "I think that both men and women can become successful engineers." The mean response to this statement was 1.21 and the standard deviation, .51. These results indicate that the KEYs Program was able to meet its objective of providing a positive, empowering experience for the girls who attended.

References

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