

PROJECT 199: A PARTNERSHIP IN ASSOCIATION WITH PUBLIC SCHOOLS, INDUSTRY, AND A UNIVERSITY TO TARGET THE RECRUITMENT OF ANGLO AND MINORITY GIRLS INTO ENGINEERING

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The underrepresentation of women and minorities in science and engineering remains a national concern which the newly established and NSF funded Engineering Academy of Southern New England is addressing as one of its goals to focus on diversity. This consortium of four New England engineering colleges is designing programs and activities which encourage underrepresented female minorities, and Anglo female students to study and eventually practice in the engineering profession.

The Women in Engineering Program in the College of Engineering at the University of Massachusetts submitted a proposal to the Engineering Academy designed for female Anglo and minority students in grades 8-12. This initiative builds upon the current activities of the Women in Engineering and the Minority Engineering programs in the College, and works towards the development of a new model. This model includes a partnership with industry, a public school system, parents, and a university. The idea for this proposal is supported in the research being carried out by AAAS, Department of Energy and NSF. They have targeted programs on math and science education for females and minority females which no longer focus on these populations as "somehow deficient, in need of alteration, so that they can fit the existing environments in science and engineering." (Dr. Jane Stutsman, NSF, Subcommittee hearings.) Their focus is on eliminating barriers and providing climates which assist girls and women in developing confidence, and academic and professional success which can lead them towards careers normally seen as non-traditional and "male-dominated."

The American Association for the Advancement of Science (AAAS) established a task force in 1989 to examine efforts made by higher education institutions in the U.S. to increase the participation of women, non-Asian minorities, and people with physical disabilities in science and engineering. The findings and recommendations for programs targeted at women and minorities form the basis for Project 1999. (See Investing in Human Potential: Science and Engineering at the Crossroads, Executive Summary, AAAS, 1991.)

*The term Anglo girls is an official term being used by the Holyoke public school system to identify non-minority girls.

We found the initial phases of Project 1999 to be a valuable experience in helping girls gain introductory understandings of the engineering field while also developing their communication and mathematic skills, and an understanding of the history of women in engineering and science. The pre- and post- tests, and documented anecdotal data (See Appendix B, C). An additional benefit was the elevation in the students' levels of confidence about the possibility of a career in the previously unknown field of engineering.

OBJECTIVES

The objectives of Project 1999 are to increase the pool of Anglo and minority girls eligible to attend two- and four-year colleges in 1999, majoring in engineering and, ultimately, working in the engineering professions. Project 1999 is designed on the recommendations provided by the AAAS task force study published in 1991, and other studies identified in the references. The objectives include:

- the expansion of educational and recruitment efforts into new geographic areas with Hispanic and African-American populations;
- expanding the understanding of the engineering profession as a viable career option for Anglo and minority girls;
- the participation and collaboration of parents, public schools, industry, state agencies and the university in efforts targeted toward Anglo and minority girls;
- using a hands-on inquiry approach and cooperative group work as a more meaningful and supportive teaching/learning environment;
- providing diverse role models for program participants via a college student mentor network;
- establishing an evaluation procedure as an integral part of the project; and,
- developing a stable funding base within the partnership with the support from established College of Engineering programs such as the Women in Engineering and Minority Engineering Program and their respective college-industry advisory councils.

DESCRIPTION AND APPROACH

There were seven objectives fundamental to Project 1999, as previously stated (See Appendix A).

Objective I: The expansion of educational and recruitment efforts into new geographic areas with Hispanic and African-American populations.

The Holyoke School district has a large minority population and was targeted because of its proximity to the University. The goal is to continue to build on the efforts of Project 1999 after the original project is completed.

Objectives II and III: Expanding the understanding of the engineering profession as a viable career option for Anglo and minority girls; and, the participation and collaboration of parents, public schools, industry and the University in efforts targeted toward Anglo and minority girls.

Project 1999 initiated its activities with the collaboration of the Holyoke School system, parents, industry and the University. Planning began in the fall of 1994 to gain approval from the school system. Student participants were identified by the middle school principals, applications were distributed, and candidates were selected. Meetings were held with parents, teachers, guidance counselors, and the industrial sponsor. Each group gave input to the program while also gaining understandings of their unique roles and responsibilities with these middle school students.

Objectives IV and V: Using a hands-on inquiry approach and cooperative group work as a more meaningful and supportive teaching/learning environment; providing diverse role models for program participants via a college student mentor network.

The two-week summer camp program in July of 1995 introduced the students to introductory hands-on experiences in manufacturing engineering through classes in computing design and project development. In addition, classes were taken in Women in Engineering, mathematics, and in multicultural and communication skills development.

Other experiences included field trips to American Saw & Manufacturing Company, Springfield Science Museum and University Museum featuring an exhibit of women's clothing designed by Nicaraguan Village women developing a cottage industry.

The mentor network included the participation of female undergraduate students in engineering who were Project 1999's tutor/counselors. Other role models included female engineers and alumni of our college, who are employed in industrial positions in Massachusetts and Connecticut.

Objective VI: Establishing an evaluation procedure as an integral part of the Project.

With the assistance of a campus evaluator hired by the Engineering Academy, a pre- and post-test was designed to identify understandings students had about engineering and career possibilities. Results have been collated and are included in the Appendix .

Objective VII: Developing a stable funding base within the partnership and the continued support of the Women in Engineering (WEP) and Minority Engineering Programs (MEP) college-industry advisory committees.

This is an on-going effort to assist in the continuance of Project 1999. The WEP and MEP will remain as the mainstays of the project providing University personnel support and some limited funding from industry. The provision of personnel resources will probably be the primary source of corporate support for the foreseeable future as industries redefine themselves for the twenty-first century. Securing funds from the government agencies will also have to be a consideration although those funds are becoming scarce.

Current Status

Project 1999 is currently at the end of the NSF two-year commitment after a successful two years working with the project students, industry, and parents.

A teacher coordinator from Holyoke High School was hired to act as the in-house representative for the 1995-96 school year. She was also a teaching team member for the summer camp program in 1995.

The original student enrollment for Project 1999 was 40 students. Ultimately, 25 students participated in the summer camp, with three leaving due to an injury and illness (2), and lack of interest (1). No effort was made to follow up on the 15 no-shows as the three middle school principals suggested it was normal to have this attrition rate. It suggests, however, that the recruitment process should have included a larger pool of applicants to achieve an enrollment of 40 students.

This academic year has included planning meetings with the teacher coordinator and the industrial representative. A reunion meeting was held at the high school for the girls who participated in the summer camp. And, with the assistance of the high school bilingual guidance counselor, two additional Hispanic girls participated. Recommendations were given for six new recruits.

Activities have included workshops on going to college, a career panel and an on-campus Project Day for the girls under the sponsorship of the University's student chapter of the Society of Women Engineers.

As there has not been an extension by NSF supporting the Engineering Academy, the summer camp will be held in July but changes will be made in Project 1999's future plans. In the fall the Women in Engineering and Minority Engineering Program, SWE, SHPE, NSBE will join to continue the efforts of Project 1999 in a scaled-down version.

Pre- and Post-Tests Results

Awareness

In the pre-test on Awareness, questions 1-4 demonstrated little to no understanding of what is engineering, and what is manufacturing engineering, and how is it different from other industries. Responses to the same questions in the post-test clearly demonstrated the understandings which had developed about engineering as a profession which made things at reasonable costs, made peoples' lives easier, and designed products using math and science concepts. The students also stated the importance of communication skills and knowledge of computers as foundations for studying engineering.

Interest Level

The results of the pre- and post-tests indicate a significant improvement in the students' understandings of engineering involving interesting work, and as it being a good career for women and minorities. However, there was a decline in their interest in furthering their education in a discipline that utilizes mathematics. This could be due to the fact that the math teacher designed her course as a preparation for high school math and the students were not prepared for this style of teaching and her expectations.

Self-efficacy: Coursework

In the Self-efficacy pre- and post-tests there were improvements in the students' understandings that minorities can be as successful as non-minorities in engineering courses and the belief that universities want more women and minorities to study engineering. The areas in which the students experienced a decline in confidence were in math abilities and problem-solving.

Self-efficacy: Careers

While the students demonstrated more confidence in all questions in this part between the pre- and post-tests, they demonstrated significantly more confidence in their beliefs that companies are as interested in hiring women for engineering as they are in hiring men, and that minorities can successfully compete with non-minorities in the engineering job market.

PROJECT TRANSFER PLANS

The Engineering Academy of Southern New England Diversity Council model allows for an easy transfer of specific program activities and related materials; the members of the council are automatic resources to each other. The council's initiatives will provide a broader based network of information and ideas to all its participants.

All materials of Project 1999 will be incorporated into a final report in loose-leaf format for easy duplication and will be distributed to the academic institutions on the Diversity council.

Specific activities which are anticipated to evolve from the Project are:

1. educational workshops for middle/high school teachers, administrators and parents;
2. presentations by faculty, students and industrial reps at high schools in Holyoke;
3. use of professional videos produced by engineering societies, community organizations, industry and the University;
4. computer learning modules developed by University and Magnet school;
5. tours of different industrial sites and the University; and,
6. presentations at national conferences such as the Society of Women Engineers (SWE), Women in Engineering Program Advocates Network (WEPAN), National Society of Black Engineers (NSBE), and Society for Hispanic Professional Engineers (SHPE).

BIBLIOGRAPHY

- American Association for the Advancement of Science. 1991. "Investing in Human Potential: Science and Engineering at the Crossroads." Washington, D.C.: AAAS.
- Baum, E. 1989. The Cooper Union 1989 National Survey on Working Women" Engineers. New York: The Cooper Union for the Advancement of Science and Art.
- Canadian Committee on Women in Engineering. 1992. "More Than Just Numbers." Summary Report. Fredericton: National Telecom - NSERC Women in Engineering.
- Catalyst. 1992. "Women in Engineering: An Untapped Resource." New York: Catalyst.

Hall, R. and B. Sandler. 1982. "The Classroom Climate: A Chilly One for Women." Project on the Status and Education of Women. Washington, D.C.: Association of American Colleges.

National Society of Professional Engineers. 1992. "The Glass Ceiling and Women in Engineering." Alexandria: NSPE.

Rayman, P. and B. Brett. 1993. "Pathways for Women in the Sciences." Wellesley: Center for Research on Women.