A MODEL PROGRAM AT VIRGINIA TECH: THE C-TECH^2 PROGRAM FOR HIGH SCHOOL WOMEN

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INTRODUCTION

Many universities, organizations and corporations have taken the initiative in the last decade to encourage young women into the engineering pipeline by organizing and implementing pre-college programs. Project 1999 was designed to encourage underrepresented female minorities and Anglo female students to study and eventually practice in the engineering profession. The commitment of a manufacturing company as a sponsor and involvement of parents are features of the program.[2] The Penn State New Kensington Campus offers an annual, two-day seminar program targeted at ninth through eleventh grade females from local high schools.[1] As part of the national "Take Our Daughters to Work" day sponsored by the Ms. Foundation, the Women's Center at Virginia Tech has been highlighting non-traditional majors, including engineering, math, and science. These are just a few examples of model programs that have been implemented across the nation.

C-Tech^2 (Computers and Technology at Virginia Tech) is a four-week residential summer program, open to rising eleventh and twelfth grade females enrolled in high schools through the state of Virginia. Now in its third year of operation, the program allows young women to explore applications of computers, engineering, math, and science in a way that will inspire an interest in technology as a future college major and career choice. The participants spend the majority of their time involved in instructional and hands-on activities designed to increase their knowledge of, and interest in, applications of computers, engineering, math and science to real world situations. Like similar pre-college programs, the C-Tech^2 program provides one tool for recruiting women into the engineering and information technology pipeline.

Another focus of the C-Tech^2 program is the experience of learning about college life. Participants have the opportunity to learn what it's like to live in a dormitory, eat in a dining hall, experience extracurricular activities, and meet other students from diverse backgrounds. The participants attend seminars, workshops, and tours provided by the

admissions office, scholarships and financial aid office, the counseling center, the library, and the career services office. Presentations and lab tours conducted by individual engineering departments help the participants explore the academic and career opportunities associated with the respective engineering fields. Opportunities to interact with undergraduate women pursuing engineering majors and women engineering faculty provide the participants with non-traditional role models.

PRE-PROGRAMMATIC PLANNING

Although C-Tech^2 is a summer program, the planning for the program occurs throughout the calendar year. In the fall of the year, application materials (a brochure, application, parental consent forms, financial statement, and letters of recommendation forms) and the website (http://www.eng.vt.edu/eng/omep/ctech2.html) are updated. In addition to these items, all applicants are required to submit an essay and official copies of their high school transcripts. The two-part essay topic "Is technology important to your future? Why or why not? Why should you be selected to participate in this program?" is weighted relatively heavily, along with academic performance in math and science classes, in the selection process.

Applications are mailed to all math and science division chairs and guidance counselors in all Virginia high schools, including public schools, private schools, and Governor's schools. Applications are also forwarded to organizations such as 4-H, the Girl Scout Council, CHROME (Coordinating Hampton Roads Organization for Minorities in Engineering), and RAPME (Richmond Area Programs for Minorities in Engineering). One major goal of recruitment is diversity. The program has been successful in recruiting equal numbers of African American, Asian American, and Caucasian women. While the cost of the program to participants is $400, partial and full scholarships have been offered to those young women who demonstrate financial need. With thirty-six participants, the overall cost of the program is somewhere in the range of $40,000 – 45,000 with the most significant expenses being the costs associated with on-campus housing and dining followed by salaries and wages for instructors and other program staff.

After applications are mailed, there are many arrangements that must be made: on-campus dormitory housing, meal plans, reservations for classrooms and other facilities, van and bus reservations for field trip transportation, assignment of personal IDs (PIDS) for electronic mail, installation of computer software, and completion of paperwork for phone hook-ups. Insurance information must be forwarded to the risk management office, and medical forms must be forwarded to the student health center. Strong project management, time management, and organizational skills are important to ensure that no details are left undone. Most of the arrangements are ongoing, and coincide with the process of advertising, screening and reviewing both student applications and program staff applications for employment. Faculty, staff, students, and engineering student organizations are also recruited as volunteers for various presentations, seminars, workshops, and hands-on activities as part of the program schedule. Scheduling is also

an ongoing process as the program schedule is fine-tuned over a period of several months. Eventually the dorm counselors will plan many of the dormitory and social activities. The weekend that falls in the middle of the four-week period is set aside as a visitation weekend in which the participants can have visitors on campus or visit friends or family off-campus.

Interviews and selection of instructors, dorm counselors, and program staff occur in early spring. As recommended by the American Camping Association guidelines, the number of dorm counselors hired will depend upon the number of program participants. Staff training is held in the late spring. Components of staff training include: new employee orientation (employee paperwork, payroll, and time sheets); specific program information; roles and responsibilities of program staff; and crisis response. Crisis response includes information on how to deal with medical emergencies, behavioral incidents, personal problems, and violations of rules and regulations. All program staff meet weekly throughout the course of the four-week program.

After review, student applications are organized into three categories: those selected for the program, those placed on a waitlist, and those omitted from the program. Applicants are mailed correspondence accordingly. Those applicants selected for participation in the program are given a time limit to return a reply form indicating whether they plan to participate in the program. Any empty slots are filled with those students who have been placed on the waitlist. All participants are then mailed a follow-up packet: a list of rules and regulations, maps and directions to campus, a list of hotels for parents in case they need to stay overnight, a visitor permission form, a medical consent form, a field trip permission form, a tuition and fees form, a preferred name form, and a computer literacy survey.

PROGRAMMATIC EVENTS AND SCHEDULE

On the day of check in, both participants and parents are given packets of information. The student packet includes a nametag and identification card, a campus map, a program schedule, participant and program staff lists, emergency contact numbers, and course materials. The packet for parents includes a letter from the director, program schedule, participant and program staff lists, emergency contact numbers, and a college brochure. On the evening of the first day, a welcome reception is held to help the girls get acquainted with each other, program staff, and selected faculty and staff in the college. Immediately after the reception, all rules and regulations are covered at an orientation meeting. Time is also allotted for questions and answers.

The instructional component of C-Tech^2 includes classes in math and computers held almost every day Monday through Friday. A library research project and oral presentation are designed to integrate computer skills, including word processing, spreadsheets, presentation, and web design and other internet skills. The participants have also had the opportunity to become familiar with the basics of C++ programming and some of the software utilized by engineering freshmen. The broad range of computer

skills and mathematics knowledge has been a challenge for the instructors. For example, while a few participants may have designed their own web pages, there will be a few who have not used computers extensively. There will be one or two who have never used electronic mail. In addition, while a few girls each year will have completed a Calculus course, the majority will have completed Geometry and either Algebra II or Algebra III/Trigonometry. One solution has been to use instructional methodology across ages and level such that the higher level students can assist with the instruction and tutoring of the lower level students.

Hands-on activities are a very important component of instruction. For the past two summers, the participants have assembled their own telephones, beginning with the soldering of the circuits and components. They have also designed and built mousetrap cars and toothpick bridges, and assembled small motors. Through a Rainfall Simulator activity, the participants have collected water samples and tested them for water quality. They have also conducted biological DNA experiments by injecting DNA particles with bacteria. Finally, through a Product Implementation Workshop, the participants have learned how to work in teams through the simulation of an activity involving design work and the sales and marketing of team designs. Teamwork is also promoted through a "candy vibration" experiment in which teams are expected to use algebraic formulas to calculate values of mass and length in order to predict the best value for optimizing vibration cycles.

In addition to exposure to college life and the various sessions mentioned in the introductory paragraph, the other components of the program schedule include a career choice and development component, seminars, field trips, contests and competitions, and leisure and social activities. Through the campus career services office, students complete self-assessments through the DISCOVER computerized career guidance system, the Keirsey Temperament Sorter, and the Purdue Test. Career counselors conduct both group and individualized interpretations of these assessments. Seminar topics include women in engineering and computing, sexual assault and harassment, and work and family balance.

Through field trips, the participants have visited Washington, D.C. and the Smithsonian Air & Space Museum, a local science museum and planetarium, a manufacturing facility, a sewage treatment facility, a waterpark, and a state park. During the summer, the town of Blacksburg and Virginia Tech sponsors a "Summer Arts Festival" offering participants the opportunity to attend Independence Day events, movies, concerts, dances, picnics, and other activities. The participants also have access to the campus student center and gymnasium.

A closing reception and awards ceremony is held the last evening of the program. At this time, awards and certificates are distributed, and each participant receives a t-shirt designed by one of the participants. In addition to the t-shirt design competition, there are prizes for the mousetrap car, toothpick bridge, library research and oral presentation, candy vibration project, as well as others. A highlight of the last evening are the

"superlatives" awarded by the dorm counselors who have had the opportunity to both work with and live with the participants.

POST-PROGRAMMATIC DETAILS

Following the conclusion of the program, thank you letters are mailed to all faculty, staff and students who have volunteered to be part of the program schedule. Post-program evaluations are reviewed as part of an effort to continuously improve the program over time. For example, last years' participants recommended a longer break for lunch, partly due to a thirty minute round trip walk to the dining hall and partly due to large numbers of other summer program participants eating during the lunch hour. Participants also recommended more free time for sending and receiving e-mail. An extra free hour was scheduled into the program immediately after computer class and before lunch to fulfill both requests. A final report, including an account of all income and expenses, is also written.

A follow-up recruiting packet is mailed to each participant, and a longitudinal survey of post-graduation plans is underway. A significant number of program participants have selected engineering, science, or computer science as college majors, either at Virginia Tech or other universities. The minority women who select to attend Virginia Tech as freshmen are encouraged to participate in the ASPIRE program, a summer bridge program for minority students at Virginia Tech. Finally, a C-Tech^2 reunion is held in the spring of the next year in conjunction with the annual engineering open house event.

CONCLUSIONS

Over time, many lessons have been learned, and an effort has been made to rectify any problems that have occurred. Students in the high schools do not necessarily receive copies of the applications through their teachers and counselors. The web site has been one solution to this problem. Presentations and round table discussion through the Virginia Counselors Association annual conference, the Fairfax County Commission on Women, and other organizations and events have also helped to promote the C-Tech^2 program. Despite these extensive efforts at publicity, the program still does not necessarily reach all the underrepresented populations in the state, for example, young Appalachian women from Southwest Virginia.

While the main focus of the program is academics, issues related to adolescent development and diversity must be taken into consideration and handled on an almost daily basis throughout the program. To promote diversity and college student life, students are assigned roommates unlike themselves, in other words, Caucasian students will be assigned Asian or African American roommates. Personality differences, cultural differences, and differences in religious backgrounds create situations that must be acknowledged. Sometimes these differences exacerbate normal homesickness and loneliness. One lesson learned has been the need for team building and education and awareness about these and all kinds of differences. The ability to be adaptable enough to

learn to work with other people that may not look like or think like themselves is encouraged. By building these components into the program, the participants begin to develop the core competencies required in post-secondary education, the workplace, and life in general.

REFERENCES

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