FAST FORWARD TO FUN EDUCATION

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Introduction

Establishing a summer program for young girls can be an arduous experience. By discussing the accomplishments achieved and problems encountered in the Rose-Hulman Fast Forward program, this paper will suggest ideas for planning, implementing, and operating a successful summer program for middle school students. Ten vital elements must be addressed when establishing a summer program including: initial planning, faculty involvement, publicity ideas, participant selection, staff counselor selection and responsibilities, educational programming, facilities and resources, recreational activities, funding, and program evaluation.

The Fast Forward summer program is designed to develop the enthusiasm of 7th and 8th grade girls for the fields of math, science, and engineering and to empower the girls through the successful completion of challenging projects. Thirty girls attended the four day pilot program in August 1994. The major project involved student teams designing, building, and testing solar powered vehicles. Seven additional technical sessions, most of which contained hands-on activities either in a laboratory or using a computer, included an introduction to the types of engineering, engineering developments in the medical field, examining the properties of plastics, investigating number patterns and geometric patterns, solving problems involving chance and probability, constructing a "light listener" that detects and converts light to sound, breaking codes and mathematical modeling. Extracurricular activities included an opportunity to interact with female professionals, team building skills, and recreation.

Program evaluation included a pre-assessment of students' knowledge and attitudes about engineering, math, and science and their perceived abilities. For post-assessment, we asked participants to rank each session or activity numerically and provide written comments.

Initial Planning

In the fall of 1995, Rose-Hulman will admit undergraduate women for the first time in its 121 years of existence. In light of this change, ten members of the Rose-Hulman faculty and administrative staff were asked to form a discussion group to develop a preliminary design for a summer program for young females. Several other factors also initiated the need for such a program. Attracting quality students has become even more competitive as college costs increase, and financial aid becomes less available, and a declining number of students chose to study engineering and science. Although, Rose-
Hulman is attempting to address this last challenge through Operation Catapult, an intensive three week summer program designed for students who have successfully completed their junior year in high school, it was recognized that we must reach students earlier in their academic career.

The initial Fast Forward planning meetings were held in December and January of the 1993-94 academic year. The group reached consensus on several points. One of the primary goals of the program would be to stimulate the interest and enthusiasm of girls at the middle and junior high school level, a point at which they would still have opportunities to make important curricular choices and build a strong academic base. The pilot program would be limited to thirty females who had completed the 7th or the 8th grade and provide an intensive four day, project driven, hands-on approach to studying math, science, and engineering. We felt that a program of short duration would be appropriate for this age student and set out to create an intensive "skunk works" environment. The dates August 3-7 were selected based on residence hall availability.

**Faculty Involvement**

To establish the curriculum and activities for the program, interested faculty were asked to submit a one page description of a design project or laboratory experiment. We especially encouraged faculty teams to assist with curriculum development. Thirteen faculty from seven different fields were actively involved in planning and implementing the learning sessions. Departments represented included mechanical engineering, mathematics, physics and applied optics, humanities, computer science, and chemistry. In addition to three general meetings held for program faculty to discuss and receive feedback on their proposed sessions, the four faculty members involved in the solar vehicle project met biweekly during March, April, and May. Care was taken to ensure that the concepts introduced were appropriate for 7th and 8th grade students' level of understanding.

**Publicity Ideas**

Since this was a new program, we felt that we needed to be aggressive in our attempts to recruit participants. With assistance from our publications office, we developed an eight panel brochure which included an application form. We established a recruitment base consisting of relatives of alumni and students recommended by middle and junior high math and science teachers in Indiana. In late March an announcement for the Fast Forward program appeared in our alumni newsletter which has a distribution of approximately 8,000. April 1, we mailed approximately 700 of our 1,000 brochures to Indiana middle and junior high math and science teachers, and asked them to give the brochures to qualified female students. Additional ways we attempted to reach potential participants included distribution of fliers at area math competitions, newspaper articles, and radio promotions. The registration deadline of May 15th worked well because work-study students were still available to help process the applications.

**Participant Selection**

Since one of the goals of the program is to develop students' interested in math, science, and engineering, participants were selected on a first come first serve basis. The brief application form, a detachable panel of the brochure, did not include a request for grades or standardized academic test scores.
scores. A fifty dollar deposit was required. Preference was given to eighth graders when last minute applications arrived with the same postmark date. Thirty participants from five states - Indiana, Ohio, Kentucky, Michigan, Illinois - participated in the pilot program. Most of the participants were from surrounding counties, and the distribution of 7th and 8th graders was 16 and 14 respectively. Ten applicants were placed on a waiting list, and one participated in the program when a cancellation occurred.

Staff Counselor Selection and Responsibilities

Because of Rose-Hulman's all male undergraduate status, we believed that finding qualified female counselors might be one of our greatest challenges. In addition to seeking females with an engineering or science background, laboratory experience, computer skills, prior summer program experience, and strong interpersonal skills, we also wanted women who were familiar with the campus. The Assistant Dean of Students who was responsible for recruiting student counselors for our first coeducational high school summer program last summer offered to supply us with the names of possible female counselors. Potential candidates were contacted personally and asked to complete a counselor application form. After the applications were reviewed and personal interviews conducted, a female Rose-Hulman graduate student in physics was selected as a Fast Forward counselor. The Assistant Director of Student Activities who resides on campus volunteered to serve as our second counselor. In addition to acting as residential student advisors, the counselors were responsible for assisting faculty in the classrooms and laboratories and planning and implementing recreational activities.

Educational Programming

Solar vehicle

All activities revolved around the central project of developing a solar-powered vehicle. Five blocks of time, totaling approximately eight hours, were set aside for students to design, build, and test a solar powered vehicle. Each student was assigned to a team with two other participants, and each team was given a solar cell and a motor. Other materials such as gears, shafts, wood, glue, and wheels were also provided. The participants were allowed to use the power tools in the machine shop on campus after a lesson on safety and equipment use. Experienced personnel were in the machine shop at all times to provide advice and oversight, but the participants were required to do all of the work themselves. Participants were given the opportunity to see the Solar Phantom and talk with Rose-Hulman students who were responsible for designing and constructing the vehicle which was built for the Sunrayce competitions.

Additional Technical Sessions

In addition to the solar project, seven technical sessions were used to both educate and motivate the students in math, science, and engineering. Most of the sessions contained hands-on activities either in a laboratory or on a computer. These technical sessions which ranged from one to three hours in length are described briefly below.

Types of Engineering - In this first technical session, students were introduced to the types of engineering with emphasis on the contrasts between the pure sciences and
engineering. The students were encouraged to take as many math, science, and English courses as possible while in high school.

Introduction to Chemistry Lab - Students learned about plastics and their many applications. The properties of plastics were examined, and students were given hands-on experience in making "slime."

Engineering in the Medical Field - The President of Rose-Hulman, Dr. Sam Hulbert, gave the students a presentation about engineering developments in the medical field with an emphasis on biomedical materials and artificial organs.

Pattern Recognition - Scientists and engineers commonly try to identify patterns and then use those patterns to create theories and build new devices. In this session, the students used Mathematica, a computer-based symbolic computation system, to investigate number patterns and geometric patterns and to learn how to discover and describe patterns.

Fun with Probability I and II - Students learned some basic elements of probability and then used their newly-acquired knowledge to examine some interesting problems involving chance and probability.

Light Listener - Students constructed a light listener that detects and converts light to sound. During the activity, the students also learned some basic soldering skills.

Mathematical Modeling and Code Breaking - In this session the students used computers and mathematics to break ciphers.

Facilities and Resources

In December when initial discussion of developing a summer program began, we investigated availability dates for air conditioned residence hall space. Once the length of the program was established, residence hall rooms, computer laboratories, and classrooms were reserved and dining activities planned. Faculty were responsible for ordering project supplies that were not available through their respective academic departments.

Recreational Activities

To supplement participants' classroom experiences, we organized a variety of extracurricular activities. Following registration which was held in the late afternoon, all participants and their parents were invited to a cookout. After the cookout and brief welcoming program, faculty and Fast Forward counselors conducted campus tours for students and parents. Students were given a few minutes to bid their parents farewell and then assembled for "get acquainted" activities and team building exercises which ranged from weaving a web to constructing objects that reflected their individual interests.
Each day started at 7:00 a.m. as students and counselors took a nature walk in a nearby park complete with wetlands, lakes, and trails. Evening activities included tie-dying t-shirts, wacky olympics, and movies. In addition, one evening, we hosted a dinner and panel discussion with female engineers, scientists, and a physician from the community. Girls especially enjoyed this opportunity to learn about career opportunities and interact with female professionals.

Fast Forward culminated with Sunrace 94 in which participant teams raced their solar vehicles in front of a crowd of cheering parents. The vehicles were judged by faculty in a variety of categories ranging from most original design to performance. A brunch and awards ceremony concluded the day's events.

Funding

The program was supported through institutional coeducation implementation funds and participant fees. The cost of attending the program was two hundred dollars which included room and board, as well as all project materials. Although no scholarships were available for the pilot program, we hope to offer them in the future. Faculty salaries followed by participant room and board were the two most costly budget items. The Director of Fast Forward received one month's compensation for planning and coordinating the program, and the four faculty members of the solar project team each received two weeks' salary. Other faculty received a one hundred dollar honorarium for their participation.

Program Evaluation

Two assessment instruments were developed and supervised by our Dean for Academic Services. The pre-assessment tool was administered during the first evening team building session. Participants were asked to identify their educational plans after high school and rate their ability confidence level in math and science. The pre-test revealed that all of the participants planned to pursue at least four years of college and felt they possessed average to above average abilities in math and science.

For post-assessment, participants identified educational and career plans, rated each session numerically, and provided written comments. Test results were overwhelmingly positive. Using the scale of 4—very high, 3—high, 2—average and 1—low, participants were asked to rank their level of interest in each of the Fast Forward sessions. The questionnaire rankings were then averaged to compare the overall interest in each session. As illustrated in Fig. 1, students rated the hands-on activities such as designing the solar vehicle, making "slime" in the chemistry laboratory, and constructing the "light listener" higher than activities that were less interactive or involved using a computer. The students also rated hands-on science and engineering sessions higher than recreational activities. In response to which activity the students liked best, the solar project was the overwhelming favorite.

To determine the impact of the program on the participants we asked: "Will you do anything differently in the future as a result of attending Fast Forward?" Nearly eighty-five percent replied yes. In particular, six participants indicated they would take more math and science courses in high school than they had originally planned, seven students stated that they would now like to pursue a career related
to engineering, and five students expressed an interest in attending Rose-Hulman. Comments such as "it inspired my career choice," "I will take more math and science classes," and "I have a new perspective on science and engineering and I will be more interested in physics and chemistry" led us to believe that the program was successful.

![Comparison of Ratings for Each Session](image)

Figure 1: Comparison of Ratings for Each Session

Fast Forward 1995 has been expanded to sixty participants. Once again, these girls will have completed the 7th or the 8th grade and will have demonstrated an interest and aptitude in math, science, or engineering. To ensure that participants obtain hands-on engineering and science experience, the program will consist of two sessions with thirty participants attending each session. We are establishing a two year cycle of learning activities to accommodate repeat participants. In Fast Forward 1995, the main project will be the design and construction of a solar-powered water craft.

References

