

University of Utah College of Engineering Hi-GEAR: Girls' Engineering Abilities Realized

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Abstract — *To increase the number of women in engineering, the University of Utah College of Engineering designed a program to address the important decision girls face between the sophomore and junior years of high school regarding math and science. Many students are required to take only two years of math in high school in order to graduate, and in many instances, this is the time young women will “drop out” of math and science, basically closing the door to engineering careers. Similarly, female engineering students often feel isolated in their majors, finding it difficult to make friends and find support. To serve both high school and currently enrolled female engineering students, the University of Utah’s Hi-GEAR program has found a way to connect the younger girls to role models in our current students. The college level students gain an opportunity to educate girls in engineering concepts and form strong bonds with their fellow interns in engineering.*

Index Terms — *collaborations, event, high school program, recruiting*

INTRODUCTION

Hi-GEAR: Girls' Engineering Abilities Realized is an interactive, three-day event that exposed rising junior and senior high school females to many different types of engineering through demonstrations, hands-on activities, industry partner presentations, and interactions with other women faculty and students. The program has been held in June 2002 and June 2003. We anticipate extending the program to five days in June 2004.

All participants were nominated by their math and science teachers at either public or private high schools. Teachers were asked to identify female students with motivation, interest, and aptitude in math and science, wrote letters of recommendation, and personally contacted the students to encourage them to apply. In an effort to identify ethnic minority participants, presentations were given by staff at schools with MESA clubs. The number of participants (approximately 30 per year) was very

appropriate for the close interaction and teamwork embedded into the hands-on involvement with every project. Now in its third year, the program accommodates up to 40 female students. This year, the program will be expanded to five days, to allow for longer and more intensive projects. The activities and projects are planned, over a three month period, by the current engineering student interns, who are responsible for content and implementation of each activity.

PROGRAM DESCRIPTION

The program begins with the selection of college interns who apply for the positions with a letter of interest, resume and two references. We interview the candidates and look for a balance of strengths, enthusiasm for working with younger girls, different majors, and different mentoring styles. Once the interns are selected, we begin meeting to plan the program and to share ideas of how to make engineering exciting to girls who may not have had much exposure to engineering concepts. The interns are able to relate well to high school students, being only a few years older and expressing their wish that someone had held a program like this for them when they were in high school.

With direction from the staff in the Office of Outreach and Diversity, the interns identify the activities that they would like to include in the program and we begin scheduling the amount of time necessary to fill the entire schedule. The planning process for the interns becomes a valuable experience in and of itself for the female engineering majors to get to know one another and find out how much they have in common. Most interns have told us that they did not know one another before the program and that they are excited to have made new friends through their participation in their program.

In the 2003 program, we collaborated with the David Eccles School of Business to include a business component to the program. Since engineers often license, market, and manufacture engineering products, and women are under-represented in positions of leadership in both fields, we felt that gaining some business knowledge would be beneficial to our participants. One example of this collaboration was a

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very successful digital imaging activity. Program participants worked in teams to make an advertisement and pitch it to the group. They had the opportunity to learn about marketing and advertising, while experimenting with digital imaging software. Based on evaluations [Table III], we discovered that adding the business component positively impacted the participant's views of business careers (despite mixed reviews of some of the activities). 47.5% of the participants said that their interest in pursuing business as a career increased due to this program.

The schedule was full and the program was intensive with a variety of activities appealing to each participant's wide range of interests and abilities. Individually and collectively, the participants engaged in successful projects that developed self-confidence and a strong sense of accomplishment. Participants received award raffle tickets as incentives to participation and successful completion of tasks. The activities ranged from one hour demonstrations to multi-day design projects, and were designed to provide exposure to all engineering disciplines in the college.

In order to make the program successful, six interns (4 from engineering and 2 from business) worked together to coordinate the event, including: planning the activities; securing the supplies; testing the projects; preparing instructional materials; introducing the activities; scoring and evaluating the participants; and cleaning up. A schedule of the program [Table I] shows the intensity of the activities and the diversity of the topics covered.

TABLE I
HI-GEAR SCHEDULE OF EVENTS

Day 1	
Time	Activity
9:00 am	Welcome, icebreakers
9:30 am	Introduce Program
9:40 am	DNA extraction
10:50 am	Digital imaging and advertising
11:50 am	Boxed lunches with overview of majors presented by interns
1:05 pm	Digital imaging and advertising.
4:15 pm	Kudos and announcements
4:30 pm	End of day

Day 2	
Time	Activity
9:00 am	Review agenda, icebreaker
9:20 am	Budgeting for college
9:30 am	Personal finance web game
10:25 am	Chemical engineering (bouncy balls, polymers, lip gloss)
11:45	Lunch with speaker (business plan development)
1:30 pm	Bioengineering departmental tours and demonstrations.

4:30 pm	End of Day
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Day 3	
Time	Activity
9:00 am	Welcome, collect one-page scholarship essay applications.
9:05 am	LEGO Robot competition
12:15 pm	Lunch – Question and Answer segment with interns.
1:30 pm	Closing ceremony with scholarship awards.
2:00 pm	Evaluation
2:15 pm	Closing activity: Build water balloon launching trebuchets.
4:30 pm	End of day

Providing successful activities and demonstrations for participants to build awareness and interest was the number one objective for Hi-GEAR. A second but equally important goal was to involve our current women engineering students. Hi-GEAR provided an opportunity for building a sense of community and an interest in forming cohorts with these students. We found that the female engineering interns developed a strong cohort feeling, and upon completion of the program they continued to look for other opportunities for research and involvement in the college. This opportunity has helped with retention of female engineering students. [1] It also served as a networking opportunity for the interns with faculty while spotlighting them as excellent role models for the high school participants.

Funding for the 2002 program was provided by the Intel Corporation. The 2003 program was funded by the Michael Foundation. The College of Engineering and David Eccles School of Business at the University of Utah also financially contributed to the program. The budget for the program [Table II] is based on a three-day program and utilized collaboration with the colleges to keep costs to a minimum.

TABLE II
BUDGET

PURPOSE	BUDGET AMOUNT
Publicity expenses	\$300
Activity supplies	\$500
Awards & incentives	\$250
T-shirts	\$300
Room rental	\$500
Meals	\$1,600
Transportation	\$300
Intern Stipends	\$7,300
Scholarships (\$1000 each)	\$6,000
TOTAL EXPENSES	\$17,050
<i>Participant Fees</i>	<i>(\$720)</i>
<i>Grant (stipends & scholarships)</i>	<i>(\$10,000)</i>

Session

<i>Amount covered by Business</i>	\$2,400
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<i>Amount covered by Engineering</i>	\$3,930
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EVALUATION SURVEY RESULTS

All participants gave their feedback in this formal evaluation. Quotes from some of the surveys indicate that the program was a success in providing the participants with a better

understanding of engineering and computer science, and helped them explore these areas as careers opportunities. Evaluation plans for the 2004 are to administer a pre and post evaluation that more effectively measures the change in perceptions and interest as a result of the program.

TABLE III
EVALUATION RESULTS

Activity	1 Less interesting	2	3 <====>	4	5	6 More interesting	N/A
DNA extraction			5%	19%	33%	43%	
robots				5%	24%	71%	
diaper polymer			5%	24%	24%	47%	
lip gloss making				5%	14%	81%	
bouncy ball/GAK polymer				5%	33%	62%	
SCI tour (computer science)				10%	33%	57%	
ultrasound demonstration				24%	62%	14%	
circuits		5%		19%	38%	33%	5%
digital imaging			5%	5%	19%	66%	5%
Interest in pursuing business as a career before the program started.			10%	52%	19%	19%	
Interest in pursuing business as a career at the end of the program.		5%	10%	19%	28%	33%	5%
Percentage of participants whose interest in pursing engineering as a career INCREASED = 38%							
Interest in attending the University of Utah before the program started.	10%	33%	14%	19%	10%	14%	
Interest in attending the University of Utah at the end of the program.	14%	5%	19%	24%	14%	24%	
Percentage of participants whose interest in pursing business as a career INCREASED = 47.5%							
Interest in pursuing engineering as a career before the program started.	5%	28.5%		28.5%	14%	19%	5%
Interest in pursuing engineering as a career at the end of the program.		10%		14%	33%	38%	5%
Percentage of participants whose interest in attending the University of Utah INCREASED = 47.5%							

Individual comments tell the most about how the participants were influenced by this program. Some examples are:

- "I really enjoyed all the hands on stuff that was fun and I learned a lot. I also thought the interns were really nice and it's really encouraging to see women I can look up to and learn from in engineering and business."
- "I liked the SCI tour and the ultrasound demonstration because they demonstrated actual projects engineers work on. I ended up also enjoying the lip gloss and robots and the circuit because they are really different experiments, yet all apply to engineering. Overall, I thought it was incredibly fun and informative."

CONCLUSION

Participants' evaluations indicated that they were both interested in pursuing engineering as a career, as well as

attending the University of Utah. Since this program is only entering its' third year, we have yet to discover how many of our participants graduate with an engineering degree from our University. However, we are already matriculating a number of Hi-GEAR graduates into our college, and it is our hope that soon, our former Hi-GEAR participants will be serving as college interns for the next class of female high school students, and future faculty in engineering, contributing to the pipeline of future female engineers.

REFERENCES

- [1] Cunningham, Christine M. and Goodman, Irene F, "The Impact of Support Programs and Resources on Undergraduate Women's Persistence in Engineering", *WEPAN Conference Paper* 2002, page 2.

