

COLLABORATION BETWEEN THE GIRL SCOUTS OF UTAH AND THE UNIVERSITY OF UTAH BUILDING A BETTER FUTURE THROUGH ENGINEERING

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Abstract *34 Many of our traditional values discourage young women from continuing in math and science classes beyond junior high school. In addition, studies show young women between the ages of 12 and 16 begin losing interest in math and science classes. Both phenomena have contributed to the University of Utah, College of Engineering's lag behind national numbers of attending woman students. Our goal is to increase these numbers in the college by introducing young high school women to the value of engineering in society when they are beginning to consider their college and life career. We created Building a Better Future through Engineering as collaboration between the University of Utah and Girls Scouts of Utah. This program is an interactive, one-day event that exposes Senior and Cadette Girl Scouts to many different types of engineering through demonstrations, hands-on activities, industry partner presentations, and interactions with other women faculty and students. The event is designed to meet several of the requirements, as outlined by the Interest Projects Manual, for the Building a Better Future interest project. Through this type of program, the College is working to increase the total number of women engineering students – currently 12% of the total student population with a goal of 15% in 5 years.*

Index Terms *34 recruiting, event, collaborations*

INTRODUCTION

The University of Utah, College of Engineering was founded in 1895. The University is one of three Research I institutions in the state and one of the two public research institutions. It is located in Salt Lake City, center of the Wasatch Front, which comprises the majority of the State's population. The College comprises nearly 10% of the 25,000 students who attend the University, which is predominantly a commuter campus. As part of its mission, the College is committed to providing quality undergraduate education and

increasing the accessibility of its seven academic departments (8 programs) to the students of the State of Utah. Departments include: Bioengineering (Biomedical Undergraduate Program); Chemical and Fuels Engineering; School of Computing; Electrical and Computer Engineering; Material Science and Engineering; Civil and Environmental Engineering; and Mechanical Engineering. Computer Engineering is a shared program by the ECE department and School of Computing. The largest department is our School of Computing with 67 graduates in 2001, and the smallest is MSE, with usually around 10 graduates.

As in most states, the State of Utah has recently focused on the role of technology and engineering in the economic growth in the state. The Governor of the state has outlined a plan to increase the number of graduates statewide in computer science and engineering, hopefully doubling the number of graduates in 5 years. This challenge to the system of Higher Education in the state of Utah has become a vital part of the five-year strategic plan for the College. In order to fill the pipeline with students who are ready to enter engineering and technology programs, the College has recently increased its outreach activities. The approach has been three-pronged, namely:

- Increase the outreach opportunities for students in K-8 to inform students of the opportunities in engineering;
- Increase the outreach programs to high school students to inform them of the careers and programs of study at the University of Utah; and,
- Increase the outreach to freshman students in the College to aid in retention of those students.

Presently the female enrollments at the University of Utah are below the national average of approximately 20%. We have seen an increase recently due to the incorporation of an undergraduate program in Biomedical Engineering. Table I details the female enrollment statistics for 2001-02 for the College. As seen in this table, there is some variability

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among the departments but the percentages do mirror the national percentages [1] with the highest being in Biomedical/Chemical Engineering and Mechanical showing much lower percentages. The overall College numbers have remained rather stagnant at 12-13% in the last few years.

In order to increase these percentages, and in light of the Governor's plan to increase enrollments, a coordinated effort toward the recruitment and retention of women has begun. In addition, the College is also increasing its recruitment programs for other under-represented student groups as well. We are approaching a critical time to build and broaden our impact on the community by preparing more female engineers. Our five-year goal is to increase the percentage of female students in the College to 15%. Other under-represented programs have shown that once a population of 15% is realized, the feeling of isolation is minimized and more students are drawn to the program. Of course, the ultimate goal is to meet and exceed the national averages.

TABLE I
FEMALE ENROLLMENTS FOR UNDERGRADUATE STUDENTS

Department	U of U College of Engineering <i>Fall 2001</i> % of Female Students	WEPAN National Data 2000 % of Female Students [1]
Bioengineering (biomedical program)	32%	N/A
Chemical and Fuels Engineering	21%	36.3%
Civil and Environmental Engineering	13%	22.9%
School of Computing (computer science)	14%	16% INCLUDES COMP.ENG.
Electrical and Computer Engineering	9%	13.9%
Material Science and Engineering	10%	N/A
Mechanical Engineering	7%	12.4%
Entire College	13%	19.5%

To address this goal, we have initiated several new programs for females in the College of Engineering:

- Building a Better Future through Engineering – designed for young women ages 11-17; and,

- High CEAR– designed for female 10th and 11th graders.

This paper describes in detail the first program, a collaboration with the Girl Scouts of Utah.

PROGRAM BACKGROUND AND DESCRIPTION

The program was started in 2000 as a way to participate in the national, Introduce a Girl to Engineering effort through the National Engineer's Week for 2001. It was decided to focus on the older Girl Scouts initially. For this reason, Cadettes and Senior Scouts were chosen. We hope to expand our interactions with Girl Scouts of Utah to include a training program for Junior Girl Scout Leaders, which would then affect this large group of girls. In examining the Interest Projects for Cadette and Senior Girl Scouts [2], we found that the Build a Better Future Project encompassed many engineering aspects. In interest projects, girls must complete:

- **Two Skill Builder activities**, including projects such as studying blueprints, touring manufacturing plants, learning about the design of amusement park rides, and designing their own mechanical product
- **One Technology activity** such as learning about computer -aided design programs or devices to enable persons with disabilities
- **One Service Project activity**
- **One Career Exploration activity**

In total, scouts must complete a total of 7 activities in order to satisfy the Building a Better Future project.

In looking to match the research and industrial expertise along the Wasatch Front, we focused several aspects of the project as listed in Table II. Table II lists the activities for 2001 and 2002 and the connection of those activities with the interest project. Notice there was a slight difference among the activities, due to the survey results after the first year. In addition, during the first year, large, PVC trebuchets were used as the hands-on activity. This activity had no connection with the interest project, but we had done it prior to this event and it was highly successful. In the second year, smaller catapults were used versus the larger trebuchets, due to concern regarding the weather. The first year event was held in late March as compared to earlier in March the second year. The smaller catapult activity was structured for indoors as compared to the larger trebuchets, which are about 6 feet high.

In the first year, over 1000 girls were invited to attend the program with a hope of attracting at least 30 girls. Capacity

was set at 50 girls. The program was full with a waiting list of over 20 girls soon after registration began. We decided immediately to expand the program for the following year to 100 girls. This year's event involved 100 girls and some 30 adults. Based upon this year's results, we anticipate that the

limit of 100 is about right for our program. To expand beyond this figure might compromise the girls' access to hands-participation and certain tours.

TABLE II
RELATIONSHIP BETWEEN ACTIVITIES AND THE BUILD A BETTER FUTURE INTEREST PROJECT

Interest Activity	Activity 2001	Activity 2002
Skill builder: Learn about some of the things engineers must consider when designing amusement park rides	Presentation by Mechanical Engineer for Lagoon Amusement Park	Same as 2001
Technology: Learn about CAD programs	Computer Visualization, Science Computing Institute	Same as 2001
Technology: Learn about infrasturcure in your community	Traffic Lab	Not done
Technology: Investigate how changes in car design have enhanced safety	Presentation by AutoLiv, air bags and car safety	Same as 2001
Career Exploration: Learn about careers in various fields of engineering	Gave packets of information to the girls	Same as 2001
Career Exploration: Shadow an engineer for a day	Set up girls with engineers	Not done

In addition to the activities and demonstrations for the invited participants, a second goal was to involve the female engineering students in the College of Engineering and practicing female engineers from the Society of Women Engineers. This secondary goal would hopefully serve as a networking opportunity for our students with industrial representation as well as an opportunity for them to work as a group and interact with each other. We programmed a long lunch so that each engineer and student could talk to the Girl Scouts about their careers and why they went into engineering and computer science. Table III illustrates the day's activities.

TABLE III
SCHEDULE OF ACTIVITIES

Time 2001	Time 2002	Activity
9:00 - 9:30	8:30 - 9:00	Registration
9:30 - 9:45	9:15 - 9:25	Welcome
9:45 - 10:30	9:30 - 10:25	Presentation – Roller coasters
10:30 - 11:30	10:30 - 11:30	Presentation – car safety
11:30 - 12:45	11:50 - 12:50	Lunch
1:00 - 3:00	1:00 - 3:30	Two tours and hands-on activity

Girl Scouts of Utah supplies us with the mailing lists for the Cadettes and Seniors and the College mailed out the information directly to the girls. Grl Scouts handles the registration (there is a \$5.00 fee for the program, which includes lunch and a T-Shirt) and they are on-site to ensure scouts are registered.

RESULTS

The first year surveys indicated that, despite minor problems, the program was a success. The most successful part of the program was the trebuchets. The trebuchets are large, PVC pipe pieces which the girls assembled and then used to “fling” items over the lawn. No instructions were given, but an example was available for inspection. The scouts had to work together in-groups of four or so girls. In addition, each group had at least one female engineering student/faculty member helping them. As stated previously, this activity was changed the second year due to weather concerns. A small catapult was used (see Figures 1 and 2) which flung a Ping-Pong ball. Given the indoor location, we were also able to award prizes for the longest launch.



FIGURE 1
CATAPULT ACTIVITY



FIGURE 2
CATAPULT ACTIVITY

Another change from the first year was the elimination of the “shadow” portion of the schedule. During the first year, only a few girls signed up for this activity, but it proved to be extremely difficult to coordinate the competing schedules of the scouts and industrial contacts. While we believe it is a valuable experience, we feared with the larger group of scouts, we would not be able to accommodate the needs and schedules of the scouts who signed up. Clearly, more interactions between scouts and professional engineers would be beneficial as well.

The cost for the 2002 program was approximately \$3500. This total includes the cost of all materials, food and rental expenses incurred for the event. Since we only charge a fee of \$5.00 for the event, the girls are getting a great experience for their money. Due to the 50% increase of participants from

2001 to 2002, we are considering raising the fee amount to help cover some of the expense for 2003's event.

Table IV shows the results of the Year 2 (2002) survey. As seen in this table, the program was a success, with various activities highlighting the day. The fluids lab tour and visualization tour were highly successful. During both of these tours, the scouts learn about two different research activities in the College of Engineering. The visualization tour illustrates a 3-D imaging of a MRI scan of a human brain (SCI Institute). The interaction of computer science and medicine is a successful combination for those who might be interested in various medical fields but have not been exposed to the use of technology and the value of technology in these fields.

The roller coaster presentation has been very successful both years. We are fortunate to have a Mechanical Engineering graduate from the University of Utah who is employed at the local amusement park. His presentation focuses on roller coaster design, safety, and the engineering behind these items. In addition, he discussed a new ride this year and invited the scouts to visit him at the amusement park. He also explored with the girls the importance and challenge of making rides ADA accessible. This presentation was particularly relevant, as most scouts have visited the park and probably did not associate the rides with engineering.

TABLE IV
RESULTS OF SURVEY OF 2002 PARTICIPANTS

Question	Excel- lent	Good	Fair	Poor
How was the registration process	42.6%	52.1%	5.3%	0%
How would you rate this program overall	38.9%	53.7%	7.4%	0%
How would you rate the staff	75.8%	21.1%	3.2%	0%
Do you think your friends would enjoy this program	77.7% Yes	22.8% No		
What was your favorite part of the program	44.5% catapult 17.1% Roller coaster 12.8% Flow Visualization 10.3% SCI Institute			

Another aspect of the day was the location on campus. We were located in the Fort Douglas area (our new student housing) which was the site of the Olympic Village for the 2002 Olympics. The bridge, Figure 3, is a highlight of civil engineering, and connects the Fort Douglas area with the rest of campus.

In terms of age group, the older scouts appeared to enjoy the day more than the younger girls did. We had several scouts come for the second year in a row. Since the day has been structured to complete many of the requirements of the Interest Project, it is unlikely that we will change the program dramatically from year to year; however, we will need to tell participants that the changes are minimal. In addition, the "repeat participation" and comments regarding wanting more information illustrate the interest of the girls in the program; the College needs to follow up with the scouts involved and invite them to other events, which are not targeted only toward females. Given that, for security reasons, Girl Scouts of Utah cannot give out the participant mailing list, we need to work with the organization on contacting and informing the scouts of future events. Girl Scouts of Utah did agree to help us with this, especially focusing on this fall's Career Fair where seniors in high school are invited to campus to tour two departments.



FIGURE 3
THE 2002 LEGACY BRIDGE

The quotes from some of the surveys indicates to us that the program did succeed in meeting the goal of helping the participants understand more about engineering and

computer science, and to help them explore these areas as careers opportunities. Some examples, when asked what did they learn, are:

- "Engineering is open to women and even though I'm not a math whiz, I can do it!"
- "This program has changed my perspective about being an engineer. My Dad is one and after this, it looks fun."
- "Some people actually use calculus."
- "I learned a lot about engineering and maybe that will help with my career."
- "I think I might go into Computer Science when I go to college."
- "I really do need to focus on math more."
- "That engineering is a wide interesting field that I should go into."
- "Math is important! Engineering is very diverse."
- "I am a woman, Math is not my best subject, I can still be an engineer."
- "Go and do what you want and don't be intimidated."
- "I got to look at a career I am thinking about taking up when I get older. It helped me to think about how much fun engineering is to me."
- "You have to think outside the box."
- "Engineers look at things in layers."
- "To work hard and you can get anything you want."

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REFERENCES

- [1] WEPAN, Data and Statistics, http://www.wepan.org/documents/protected_data.html
- [2] Girls Scouts of the USA, *Interest Projects for Cadette and Senior Girl Scouts*, 1997, page 52.