

ARGONNE NATIONAL LABORATORY'S INTRODUCE A GIRL TO ENGINEERING DAY

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Abstract — *Although substantial effort has been made to increase the number of women in science and technology, women continue to be severely under represented in the engineering profession. Research shows that girls and young women lose interest in subjects and the fields of study leading to engineering careers long before they enter college. Therefore, reaching out to girls in their early teen years and introducing them to the engineering profession is essential. Argonne National Laboratory's "Introduce a Girl to Engineering Day" (IGED), held for the first time on February 21, 2002, and again on February 20, 2003, utilizes job shadowing as a means to reach out to middle school aged girls and provides positive role models of women engineers. The program enables women engineers to connect with the next generation and share their passion for applying scientific and mathematical principles to solving difficult problems. This event is successful at both filling the need to educate middle school age girls that engineering is a rewarding career option for them, and providing satisfaction to the women engineers who become mentors for a day. This paper explains the organizational process that took place to create this event, and the job shadowing activities that were held throughout the day at Argonne National Laboratory.*

Index Terms — *Job Shadowing, Mentoring, Student Outreach.*

INTRODUCTION

Although great strides have been made over the past few decades in providing opportunities for young women to enter scientific and technical fields, statistics show that women continue to be significantly under represented in engineering [1].

- Only 19% of the science, engineering and technology work force is female [2].
- In 2000, only 9% of engineers were women [3].
- The percentage of women graduating with computer science degrees has decreased 25% since 1985 [3].

To remain competitive and meet the future technical and scientific needs of the U.S., women and minorities will need to enter science and engineering in much higher numbers. In addition, many jobs of the future will require technical skills.

- Nearly 75% of tomorrow's jobs will require use of computers; yet fewer than 33% of participants in computer courses and related activities are girls [4].

The question remains, why aren't more women in engineering? Research shows that girls lose interest in subjects and fields of study related to engineering long before they enter college.

- By the eighth grade, twice as many boys as girls show an interest in science, engineering and mathematics careers [2].
- Fewer girls than boys enroll in computer science classes, feel self-confident with computers, and use computers outside the classroom [5].
- By the eighth grade, girls' interest in mathematics and confidence in their mathematics abilities have eroded, even though they perform as well as boys in this subject [6].

It is believed that the lack of women engineers as role models in the media and real life contribute to this trend [7]. How can we fill the gap, and interest more girls and young women in pursuing engineering careers?

To actively contribute to efforts to increase the number of women in engineering, Argonne National Laboratory participated in the nation-wide program called "Introduce a Girl to Engineering Day." Argonne successfully combined its U.S. government science and engineering research laboratory work environment with its staff of women engineers as a means for providing positive role models for young women during a day of job shadowing.

"Introduce a Girl to Engineering Day" is an outgrowth of the first National Engineers Week Diversity Summit, held in October 1999. Since this summit, National Engineering Week has organized three nation-wide "Introduce a Girl to

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Engineering Day" annual events to initiate an interest in engineering and encourage young women to consider this as an occupation. For National Engineers Week 2003, the engineering community was asked by the National Engineers Week committee, a consortium of more than 100 engineering societies and corporations, to continue "Introduce a Girl to Engineering Day" for a third year. The goal of the National Engineers Week 2003 organizing committee was to have 125 organizations, up from 117 the previous year, mobilize as many women in engineering as possible - a target of 11,000 - who, along with their male colleagues, would reach more than one million girls. A list of corporations, government organizations, universities, and other societies that participated in IGED 2003 is provided on the Web site http://www.eweek.org/site/News/Eweek/2003_nationalpledgeroster.shtml.



FIGURE 1:

NATIONAL ENGINEERING WEEK 2003 IGED LOGO

OVERVIEW OF ANL'S IGED

Argonne National Laboratory participated in IGED for the first time on February 20, 2002. An organizing committee of three ANL R&D women staff reviewed the materials provided by the National Engineering Week organization to decide how best to participate in the nation-wide IGED event given access to ANL's research facilities and variety of disciplines of women engineers. The ANL IGED committee comprised Maryka Bhattacharyya, Biosciences Division, ANL Women in Science and Technology Program Initiator; Kirsten Laurin-Kovitz, Nuclear Engineering Division, Mechanical Engineer; and Debby Quock, Physics Division, Chemical Engineer. After investigating current concepts on why there is a lack of interest in engineering among young women entering college, it was decided to target middle school age girls in order to increase their awareness of career options, help plan their high school curriculum to fulfill engineering college entry requirements, and better prepare them for the demands of the engineering profession.

The primary approach of ANL's IGED was to allow students to "shadow" a woman engineer for the day, and gain the following:

- Positive, real-life examples of women in engineering
- Answers to questions like "Why do I have to learn this?" and "Would I want to make engineering a career?"
- Insight into a job in engineering – not only job characteristics and responsibilities, but also what an engineering profession requires on a day-to-day basis
- First-hand experience about what it takes to be an engineer from the people who know best – working professionals
- List of high school courses to prepare them for this profession

The schedule for Argonne's "Introduce a Girl to Engineering Day" was as follows:

Morning of IGED The student's parent or guardian drove her to ANL.

8:30 a.m. Students met their Argonne engineer mentors at the ANL Visitor Reception Center.

9:00 a.m. to 9:45 a.m. All students and engineer mentors met at the ANL cafeteria dining room for a continental breakfast and keynote presentation on ANL, Women Engineers at ANL, overview of engineering disciplines and salaries, and recommended high school preparation courses for pursuing a college degree in engineering.

9:45 a.m. to 1:00 p.m. Students and engineers began job shadowing and visited the engineer's office, laboratory, and other facilities specific to that engineer's job responsibilities. Engineer mentor and student ate lunch together on their own schedule. An optional tour of the ANL robotics laboratory was offered.

1:00 p.m. to 2:30 p.m. Students and engineers met in the Physics building auditorium. A short presentation was given on the ATLAS accelerator (10 minutes). Small group tours were given of ATLAS (30 to 40 minutes) with demonstrations set up on ion source generation, cryogenics, and target detectors. Following the tour, all participants returned to the Physics building auditorium to pick up and fill out the student evaluation form.

2:30 p.m. – End of Day Engineer took student back to the ANL Visitor Reception Center. Student was picked up at the visitor's center by her parent or guardian, and driven back to her school or home.

RECRUITING ENGINEERING MENTORS

Argonne National Laboratory is a multi-disciplined, multi-faceted research facility with approximately 4000 employees. For ANL's first IGED, the ANL Human Resources department provided a list of all women engineers at the lab. There are roughly 180 women scientists and engineers at ANL, but there was some uncertainty as to which of these women staff actually perform engineering

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work or have academic degrees in engineering. An email letter was sent to those on the list, announcing plans for IGED and requesting volunteers to serve as an engineer mentors for a day of job shadowing. Preparations for ANL's second annual IGED included an article in the ANL weekly lab-wide newsletter that called for volunteers for this event. This newsletter announcement generated interest from men engineers as well as women engineers. Three men engineers participated as mentors in ANL's IGED 2003, a very much welcomed addition to the original core of volunteers.

Once the ANL engineer mentors were identified, they attended a preparation meeting to review the activities for the day and their responsibilities. The engineers were asked to write a short biography on why they chose engineering as a career. At this meeting, they were also given the following handouts to help prepare them for a day of job shadowing:

- Guide for High School Women on Becoming an Engineer, Society of Women Engineers (SWE) [8]
- Engineering Discipline Descriptions and Salary Data
- Job Shadowing Student Handout
- Job Shadowing Tips for Mentors
- Letter to the Parents and School of Participating Students
- Student Application Form
- National Engineering Week "Introduce a Girl to Engineering" booklet [7]

RECRUITING STUDENTS

The next step was to recruit students to participate in IGED at ANL. Finding middle school students who were interested in participating in a day of job shadowing with an engineer was not a problem, and on the contrary, the response was overwhelming as students had to be turned away. Some engineers took on two or three students for the day. The engineer mentors were given the option of taking the ANL school letter, student application form, and Argonne map to a middle school of their choice, and explain to the office personnel that they would like to sponsor an individual girl for a day of engineering job shadowing. If the engineer mentors did not have the time or were not able to locate a middle school student, the ANL IGED organizing committee made arrangements for locating and pairing up a student.

The article in the Argonne Newsletter requesting volunteer engineers, also announced to employees that their daughters, nieces, etc. were invited to participate in ANL's IGED event. Several employees not only brought in their own daughters, but some of their daughters' classmates as well. The enthusiasm from ANL employees to be able to have their daughters and other girls participate was refreshing and confirmed this activity was worthwhile.

STUDENT MATERIALS

Each student was sent home with a "goody bag" that contained a certificate signed by the ANL Deputy Director Dr. Beverly Hartline, a compilation of the one-page biographies of all the engineers that participated as mentors that day, a National Engineering Week t-shirt, handouts on why and how to become an engineer, and an ANL flashlight keychain. A similar certificate of appreciation was given to the engineering mentors and other ANL employees who helped with laboratory tours.



FIGURE 2:
STUDENT CERTIFICATE IGED 2003



FIGURE 3:
NATIONAL ENGINEERING WEEK 2003
T-SHIRT "NEW FACE OF ENGINEERING"

ALL IN A DAY'S WORK

For the first ANL IGED held in 2002, 15 students and 12 engineers participated. In 2003, there were 32 students and

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20 engineers participating in this event. A goal of doubling the number of students in the second year was met. The job shadowing activities depended upon the field and job responsibilities of the engineer mentor and provided a unique experience for each girl. The wide variety of engineers that participated as mentors added to the breadth of this event and included: chemical, computer, electrical, environmental, mechanical, metallurgical, nuclear, and software engineers. An example of one student's participation in ANL's IGED was a seventh grader at Abraham Lincoln Elementary School in Chicago who designed and created an IGED Web page for ANL as part of her job shadowing experience (<http://www.wist.anl.gov/Activities>). Another student observed first-hand what is involved when a team of engineers and scientists work together under a time constraint to resolve accelerator operations problems.

SUCCESS OR FAILURE?



FIGURE 4:
ANL IGED 2002 PARTICIPANTS

If a picture is worth a thousand words, the picture above would clearly state success. To measure strengths and shortcomings of the IGED events, evaluation forms were given to the students at the conclusion of the day's activities. They were given about ten minutes to answer 22 questions and provide comments. The student comments were positive for the most part. For the 2003 IGED event at ANL, the question on the student evaluation form 'What was your overall opinion of "Introduce a Girl to Engineering Day"?' scored as follows:

- Excellent – 11
- Good – 18
- Fair – 2
- No Opinion – 1

A few students stated that the laboratory tours and technical explanations could be made easier to understand, and there should be more hands-on activities. Some of the

written comments from the students were: "I thought it wouldn't be as fun as it was." "All the people at Argonne helped me to understand what an engineer does, and the different types of engineering." "I learned more today than I have in 7 years of science." "I really enjoyed ATLAS and the fuel lab."

A follow-up meeting was held for the engineer mentors after IGED 2002 to learn what worked and where improvements could be made next time around. The mentors also expressed that they found participating in IGED rewarding.

Feedback was also received from the engineering mentors and the parents of participating daughters via email. An ANL employee whose daughter participated, stated, "I just wanted to thank you both for putting on a great program! My daughter and her friend learned a lot during the day and it helped to give them a glimpse at a potential future career. It is great to see ANL putting on such wonderful programs. Thanks again!" An ANL engineer mentor wrote "Thanks so much for hosting and organizing a great day yesterday! I think that your efforts will have a wonderful and very positive impact on these kids for the rest of their lives. What more could one ask for!" Another ANL engineer mentor stated "If you think about it, these girls are coming to a National Laboratory and getting to see technology that they couldn't pay to see. They're working with people who have developed technology that will change the world."

LESSONS LEARNED

It is difficult to imagine planning any activity that involves bringing students from various middle schools (ages 12, 13 and 14) into a high-security U.S. government research work environment, pairing them up with an engineer for a day of job shadowing, and scheduling tours and presentations throughout the day without something going astray. Thankfully, both IGED 2002 and 2003 went off without any major glitches. This is attributed to careful planning, and input and guidance from several different divisions at ANL such as the Department of Educational Programs and the Diversity Programs Office. A key aspect of organizing and conducting the event was clear and frequent communication with students, families and mentors.

It goes without saying though that a few lessons were learned during the first IGED held at ANL. The first IGED got off to a late start as a car full of students being driven in by their Girl Scout leader arrived late due to inclement weather and traffic. However, Dr. Hartline, the keynote speaker at the breakfast that year, filled in the time waiting for this last group to arrive by providing a personal story of her early curiosities of the scientific world, and how she ultimately chose a career in physics. She also engaged the students in a conversation on what their interests and expectations were for their own careers. This impromptu dialog turned out to be a great way to start off the day's

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activities. Also, the amount of time provided in the schedule for the first IGED 2002 to arrive for the tour of the ATLAS accelerator was found to be too tight as a few people arrived after the presentation had already begun. Improvements were made to the schedule for the second annual IGED by lengthening the day.

An important lesson that was confirmed is the significant value of one-on-one interaction provided by job shadowing. The impression made on the students of engineering as a career option has continued benefits as they share their job shadowing experience with their classmates and relatives.

CONCLUSION

Argonne National Laboratory's "Introduce a Girl to Engineering Day" has become an annual event due to the many beneficial outcomes. The students were provided the opportunity to meet other students with similar interests from throughout the Chicago area, they observed women engineers on a personal level and experienced their mentor's work environment, the students learned what courses to take in high school to prepare for an engineering college curriculum, and they were advised of the various engineering disciplines and the benefits and satisfaction of the engineering profession. A goal for next year is to have more engineers at ANL involved as mentors for a day of job shadowing and sharing their scientific and problem solving enthusiasm with the next generation of engineers.

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