

A SWE Industry/University Alliance for Grades K-12 Outreach

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Introduction

This paper describes a K-12 outreach program developed by professional members of the Society of Women Engineers (SWE) Region G section located in the Paducah area, and the SWE student section located at the University of Kentucky (UK) Paducah Extended Campus. The UK-Paducah SWE student section is small, consisting of around ten students. However, this student section has the unique advantage of being located in a heavily industrialized region, which has meant a large support structure of female professional engineers in the area. There are six practicing and one retired professional engineers locally that are part of the SWE Region G section. The development of the program has been a collaborative effort, with the main goal of stimulating interest in engineering as a career for K-12 female students. The accomplishment of this goal will be through a combination of hands-on activities, pointed question and answer sessions, and, most importantly, through the intimate contact with females actively working, or pursuing, careers in engineering. The effort has involved extensive meetings with participation from both students and professionals. These meetings have involved scrutinizing past outreach efforts that have had limited success, and developing new methods of approach.

Background

The pursuit for a coordinated K-12 outreach program came out of the frustration experienced in the past trying to secure an audience for previous activities. In the past, other than an occasional Girl Scout demonstration, our K-12 outreach activities consisted of a program entitled, "Introduce a Girl to Engineering" that took place during our annual Engineering Day activities. UK-Paducah hosts an annual Engineering Day, open to the public, which includes many on-site demonstrations and competitions such as the Edible Car Competition, the Egg Drop, and Bridge Building Contest. Our program consisted of a panel format with the panel made up of both professional female engineers from local industry and female engineering students. The program began with a general slide show about the engineering profession followed by each panel participant spending 5 or so minutes talking specifically about their personal background in

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engineering, and whatever they wanted to share that would benefit a girl considering engineering. The last few minutes were spent with a question and answer session.

We had limited ourselves to this yearly event for the last three years. The success of the program was variable, depending on the timing with other Engineering Day events. Our best attendance was in the second year, when the program was located over the lunch hour in the main conference hall. Our SWE student members had physically gone out into the building and “rounded up” as many girls as they could find. In other words, our attendance was not totally voluntary. However, once the girls were in the hall, they became very enthusiastic during the program. That particular question and answer sessions was very lively and went over the allotted time. However, last year, we were put in a large classroom at the far end of the building, at the same time as other, very popular, E-Day events, and the attendance consisted of two grade school girls. Talking amongst ourselves after the program, we concluded a different venue was necessary to assure a good audience. We also realized that the panel format was better suited for “older” girls, grades 9-12, who made up a very small percentage of Engineering Day attendees. Many of the topics mentioned by the panel were not applicable to a young crowd, such as family planning issues, dealing with male coworkers, and college courses. These were issues the older girls were now considering in their career decisions. We realized the need to tailor our program to the audience, and develop something new for the younger girls.

The Planning Process

The majority of the planning process took place during the summer months, with a total of three face-to-face meetings held, and numerous email discussions. In a typical university environment, this timing would imply limited to no student involvement. At the UK-Paducah campus, basically consisting of one engineering building located adjacent to Western Kentucky Technical College, many students are local to Paducah, or surrounding communities. Therefore, our student involvement was better than would be expected. However, with a heavy industry presence, many engineering students are employed, gaining valuable work experience. Therefore, most planning meetings took place in the evenings, with less than 100% involvement of both professionals and students. The summer planning committee consisted of three industry professionals, one faculty member, and four students. Regular e-mails were sent out to summarize planning meetings, and some feedback from non-meeting attendees was assimilated in that fashion. The ethnicity of those involved in the planning were primarily white females, though one African American female student was a key contributor.

We decided the best approach would be to go to the schools and target certain age groups. We faced some challenges. We realized we couldn't target females specifically in the classrooms since we would typically be invited to math and science classes, which would include males (and probably a greater percentage of males in elective courses!). We realized it would be difficult to address a girls-only audience in this setting. In order to speak only to girls, we would need to set

up a special assembly that included girls only, which didn't seem appropriate. In the end, we felt two different formats would be necessary to cover our target range of grades K-12.

K-8 Program

The first format, called Program A, is set up as a presentation/demonstration format. This program is recommended for grades K-8, and for classroom or student clubs. Program A consists of a color slide show on the engineering profession aimed at answering such questions as: what is engineering; what do engineers do; what are the different types of engineering, and what courses should I take to prepare myself for engineering college. The slide show is then followed by a demonstration(s), which would include participation by the students.

A pool of four demonstrations were chosen from the SWE website <http://www.swe.org/iac/LP/index.html> that provides a listing of many excellent hands on activities for demonstrating the different fields of engineering. For our first year of demonstrations, we chose Paper Structures, which involves building a book supporting structure out of just sheets of paper and masking tape; Oxidation and Corrosion, where the students experiment using different compounds to clean oxidation and corrosion off of metallic objects; Asphalt Cookies, where students mix aggregate (nuts, coconut, etc.) into binder (chocolate sauce) to make a piece of "asphalt;" and, for the fourth demonstration, we chose Electricity, where the students build a simple electrical circuit using a battery, resistors and a buzzer. All the materials for this demonstration can be purchased at a local Radio Shack. The first three demonstrations were chosen mainly due to the backgrounds of the professional engineering participants (civil, materials, and chemical engineers), and Electricity was added because it was a good demonstration that we felt the students would enjoy and learn from. To aid in transporting the Electricity demonstration, the buzzers and lights were mounted on boards, painted UK blue, with two stations (a station consisting of one buzzer and one light) per board. A total of three boards, or six stations, have been constructed.

During the UK-Paducah Engineering Day event this year, SWE sponsored a Hands-On Activities session that ran continuously for four hours. We used this opportunity to try out and assess student interest in three of the four demonstrations chosen for our outreach efforts. The demonstration that was not set up was Oxidation and Corrosion. The main problem with this demonstration is finding enough oxidized materials for the students to clean. All three sessions were popular with a wide range of ages, the majority being from 7-12 years old.

High School Program

Program B consisted of a presentation and panel format, such as what had been used in our previous Engineering Day program. The brochure recommends this program for grades 9-12,

as co-ed or girls only, and is suggested for career days, special assemblies, and student clubs. As with Program A, the program starts out with a slide introduction to inform the students about engineering in general. However, unlike Program A, the presentation is followed by a panel of three or more women, of which at least one is an engineering college student. Each participant on the panel takes a turn giving a five minute talk, which includes giving personal accounts of their experience with working as an engineer or obtaining an engineering education. They may share a funny story about being a woman in engineering (for girls only audiences) or words of advice concerning family, work or school issues. After the panel members finish, the room is open for questions, and the atmosphere is kept as informal as possible to promote student interaction with the panel members.

The separation of grade levels for the two programs was felt to be necessary because we decided the chosen demonstrations in Program A weren't sophisticated or challenging enough for high school students. The committee felt the need to develop a computer-based modeling demonstration for use in the high school classroom, and hope to do that in the future. For Program B, the issues brought up in the panel format, such as family, work and college issues, are felt to be more of interest to the Grades 9-12 students.

The next challenge was how to advertise our programs to the schools. We decided that a tri-fold brochure would be developed and provided to the area schools. We gave our outreach program the title of "How About Engineering?". The front page of the brochure opens up to a listing of the two programs that includes information about each program (see Figure 1). In the two adjacent inner pages of the brochure photographs of the participants are included, both professional engineers and the UK-Paducah Engineering Students. Located on the backside of the brochure, a reservation form is provided, which interested teachers can fill out and mail (see Figure 2). On the last fold we list the UK-Paducah SWE student section contributors, who provided the funds to help buy the demonstration materials.

Distribution of the brochure has been accomplished through a combinations of mass mailings to area schools and handing out at career days by our school representative, Bonita Lykins. The mass mailing includes schools in rural Kentucky counties (Marshall, Livingston, and Graves), as well as Paducah city schools and local McCracken County.

For both programs, a handout was constructed to distribute at the end of either program (See Figures 4 and 5). The handout contains a quiz, suggestions on what to take to prepare for study in engineering, and suggested websites to learn more. The information for this handout was taken from the www.asee.org/precollege/assess.cfm website. After passing out this handout, a suggestion will be made to go over the handout with their parents. Also included on the handout is contact information for the UK-Paducah College of Engineering.

Program Response and Assessment to Date

A copy of our first, mailed response came from Reidland Elementary and is shown in Figure 3. We found ourselves already challenged by the suggested one large class of 63, so opted for the three separate presentations (though that meant an all day commitment). Fortunately, this request took place during our spring break week, so an all day commitment was possible by two professionals and two students. If we have a similar all-day request during a typical semester week, we will need to have different groups participate depending on everyone's schedule. Since the program has a large pool of participants, at least this year, this would hopefully be arranged.

We have had another request for a middle school career day. However, since our contact with the students would only be for 25 minutes at a time, the two programs in the brochure would not be possible. Therefore, we opted to inform the students about engineering, and there would not be time for any hands-on demonstrations.

The success of Program B is questionable. The chances of securing a female audience at a Career Day or club meeting seems unlikely, and we have had no responses for Program B at this time. Instead, we are currently working on having a group of high school girls come to the campus on a Saturday this May for an all day event. The day would include breakfast and informal meeting between participants, training on a 3-D printer software, lunch during the panel discussion, and using software to produce a 3-D object. Bringing the girls to campus is looking like a better option than hoping to be invited to the school.

Currently, the outreach program has no formal assessment procedure. Under consideration is to hand out an evaluation asking the students how they liked the demonstrations or panel, and if they would consider a career in engineering.

Summary

Our commitment to outreach in the Paducah area has blossomed into a multitude of ideas, and we are sure this is the beginning of successful effort. The availability of an engineering degree from the UK extended campus provides an opportunity for students who can't afford to relocate to UK-Lexington. The unique concentration of industry provides job opportunities and financial support to promising engineering students. Through the combined efforts of local professional women and female engineering students, we hope to attract more females to the engineering profession.

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How About Engineering?

**Program A:
Presentation and Demonstration Format
Recommended for Grades 1-8**

At least one participant will perform a presentation/
demonstration using the following format:

Color slide show answering:

- *What is engineering?*
- *What do engineers do?*
- *What are the different types of engineering?*
- *What courses should I take in middle and high school to be an engineer?*

Followed by an demonstration (e.g. paper structures, electricity, making a polymer).

Good format for

- ▶ Classroom
- ▶ Student clubs

**Program B:
Presentation and Panel Format
Recommended for Grades 9-12**

Allocate minimum/maximum time of 30-45 minutes
(5-10 slide Intro, 15-20 minutes Panel, 10-15
minutes Q&A)

Panel made up of at least 3 participants (At
least 1 student participant).

*Includes introduction of engineering followed
by personal accounts of engineering experi-
ences /recommendations by panel members.
Attendees encouraged to ask questions.
Informal atmosphere of panel results in lively
question and answer session.*

This program can be





- ▶ Co-Ed or
- ▶ Girls Only

Good format for

- ▶ Career Days
- ▶ Special Assembly
- ▶ Student Clubs







Participants:

Professional Engineers:

	Rhonda Lee-Desautels UK Assistant Professor Chemical Engineering
	Kathy Willet Chemical Engineering ACTS
	Laura Anderson Civil Engineering BellSouth, retired
	Jeni Dowell Mechanical Engineering TVA

Not shown:
Stacey Bridges, Air Products
Teresa Stephens, USEC
Katie Thompson, TVA
Jamie Watford, TVA

UK-Paducah Engineering Students:

	Melissa Barrett UK-Paducah SWE President Chemical Engineering
	Kara Adair UK-Paducah SWE President-Elect Mechanical Engineering
	Carrie Williamson UK-Paducah SWE Vice President Mechanical Engineering
	Adam Cook UK College of Engineering Mechanical Engineering
	Alisa Canter Murray State University Safety Engineering
	Lucinda Stowe Murray State University Safety Engineering

Not shown:
Kristin Banik, CME
Chastity Fraga, ME
Jessica Graham, CME
Ailayne Palmer, ME
Christie Perkins, ME
LaNora Westbrook, ME

Figure 1: Inside page of SWE Brochure

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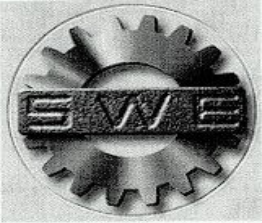
Please check program of interest and return to:
 Rhonda Lee, University of KY, PO Box 7380, Paducah, KY 42002-7380
 or call 270-534-1211

Reservation form:
 I am interested in: _____ Program A Format _____ Program B Format

Name: _____
 School: _____
 Grade: _____ No. of Students: _____ Contact Ph. # _____
 Class/Event: _____
 Date/Time: _____
 Alternate Date/Time (if possible): _____
 Time available for Program: _____

UK-SWE Paducah Section contributors include:
 Bechtel-Jacobs
 MeadeWestvaco
 Tennessee Valley Authority
 University of Kentucky SWE, Lexington Section
 USEC

**The
 Society of Women
 Engineers**



**How About
 Engineering?**

Presented by:
 SWE Region G
 &
 UK- Paducah SWE Student
 Section

Figure 2: Outside page of SWE Brochure

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Please check program of interest and return to:
Rhonda Lee, University of KY, PO Box 7380, Paducah, KY 42002-7380
or call 270-534-3122

Reservation form:
I am interested in: Program A Format Program B Format

Name: Betty M. Thompson

School: Beidland Elementary School

Grade: 5 No. of Students: 63 Contact Ph. # 538-4180 wk 488-3776 hm

Class/Event: science and math

Date/Time: Mar. 2, 9, 16, 23 (any of these)

Alternate Date/Time (if possible): see above

Time Available for Program: 8:40 - 9:25 * (1 presentation)

I have 3 different classes. If I put all 5th together, there will be 63 & someone could come for one presentation. If someone would prefer smaller classes 3 presentations will be fine with me.

- 3 presentations*
- 1. 8:40 - 9:40*
 - 2. 12:30 - 1:30*
 - 3. 1:45 - 2:45*

Figure 3: First Request for Outreach Program



National Engineers Week
Feb. 23-27, 2004

For more information on engineering programs
in Paducah, contact:

Carolyn Garrett, Student Services
University of Kentucky College of Engineering
Extended Campus – Paducah
www.engr.uky.edu/paducah

270-534-3304



The Society of Women Engineers



How About Engineering?

Presented by:

*SWE Region G
&
UK- Paducah SWE Student Section*

Figure 4: Outside of Handout

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Have you ever wondered if engineering is for you?

Take this quiz and find out! Answer the following questions with a yes or no.

- Do you consider yourself an inventor? ____
- Do you want to make the world a better place to live? ____
- Do you have an active imagination? ____
- Do you like being a problem solver? ____
- Do you enjoy group projects? ____
- Are you into drawing or building things? ____
- Did you get good grades in science and math last year? ____
- Are your writing skills pretty good? ____

If you answered "yes" to four or more questions, you might have what it takes to be an engineer!

What can you do now to prepare yourself for a successful career as an engineer?

- Take as many math and science courses as you can.
- Gain experience with computers - the hardware and the software.
- Don't neglect your English and social studies classes. Engineers need to be good communicators and aware of the problems in the world.
- Get involved in extracurricular activities to gain organizational and teamwork experience.
- Check out these Web sites:

American Society of
Engineering Education
at
www.asee.org/precollege/
and
Engineer Girl!
at
www.engineergirl.org

Figure 5 : Inside of Handout

RHONDA LEE

Rhonda Lee is an Assistant Professor of Chemical Engineering at the University of Kentucky Extended Campus Program in Paducah, KY. She received her B.S. from Kansas State University in Manhattan, KS, and M.S. and Ph.D. degrees from The Ohio State University in Columbus, OH. She also holds an M.S. degree in Metallurgical Engineering from the University of Oklahoma. Dr. Lee was employed by International Paper Company for six years in the Environmental Technology Department. She has held her current position since July 2000.