A Third Year Update on a Single-Gender Outreach Program

Thomas Banning[1], Jerry D. Newman[2]

ABSTRACT - In 2007, the Herff College of Engineering at the University of Memphis hosted Girls in Manufacturing (GiM), a week-long summer outreach program which was designed to introduce high school girls to engineering. A presentation about the initial summer program was given at the 2008 ASEE SE conference**.**

This paper reviews the revisions and additions that have been introduced progressively into the second and third summers of this outreach program. The program has expanded the number of times per summer that the course is offered as well as changing the curriculum of the program to expand the hands-on component of engineering. The program has reached out to industry and obtained additional grants which allow the program to be self funded through the annual and multi-year grants. This paper covers the successes and frustrations associated with the planning, implementation and execution of the program. Additionally the paper will give the blueprints for a successful single-gender outreach program.

Keywords: K-12 Outreach, STEM, Single-Gender, Manufacturing, GiM.

INTRODUCTION

The initial year of the Girls in Manufacturing (GiM) program was reported in the ASEE SE Proceedings in 2008 [1]. The program's initial success encouraged the department to seek continued funding from the previous companies: UTC Carrier Corp. and Cargill Corp. The second summer (2008) of activities was planned and the results were as incredible as the first summer and the program was able to offer three separate weeks of the summer program. The third summer (2009) offered two weeks of the program with the same excellent results.

BACKGROUND SUMMER 2008 PROGRAM

The use of a web-based enrollment allowed the girl to indicate her level for the next year i.e. sophomore, junior and senior, which allowed the three weeks of the program to be grouped into sophomore and junior/senior. The feeling was that age level was commensurate with maturity and educational accomplishments hence the separation of the groups of girls. The decision was made to use the identical program as the previous year because of delays in the funding decisions by the companies. The programs contained seven major elements and were scheduled into the first four days of the program and the last day dedicated to presentations by the girls given to their parents and sponsors. The seven major elements included: (1) CAD 3D drawing creations transferred to a material deposition unit, (2) Welding and painting of a picture frame, (3) CAD drawing creations transferred to a CNC mill to perform 2-D foam cutting, followed by a casting exercise to produce aluminum castings using the lost foam process, (4) MicroBot programming introduction followed with a robot programming contest, (5) Lean table-top production exercise, (6) Engineering economics discussions utilizing a table-top exercise, and (7) CAD drawing creations transferred to a CNC mill which engraved the drawing on a Lexan sheet.

[1] University of Memphis, Engineering Technology, ET 203, Assistant Professor Memphis, TN 38152, tbanning@memphis.edu

[2] University of Memphis, Engineering Technology, ET 203, Assistant Professor Memphis, TN 38152, jdnewman@memphis.edu

The program contained two separate industrial plant tours: Carrier (manufacturing) and Cargill (processing). Female speakers from local industries were brought in lunch for each day of the program and the girls interacted with questions about the women's roles in their respective industries. Because the two participating faculty members were men, female engineering student assistants were selected and they shadowed/mentored the girls during the week. It should be noted that the funding from the two companies allowed the program to be totally self sustaining, hence the student assistants and the faculty members received stipends, the busses for the tours were paid for by the funding, and all materials, lunches as well as the Friday afternoon presentation to the parents were all paid by the funding.

RESULTS SUMMER 2008

The results from summer 2008 program mirrored the outcomes from summer 2007. From the feedback of the parents and student: (1) the late approval of funding was not allowing us to advertise additional summer sessions until the funds were approved. This lead to many countless Emails and phone calls to establish the three weeks of the program and insure that girls were matched with the proper class groupings, (2) the faculty and student assistants were worn out from the weeks of the development and execution of the program, (3) the faculty found that they were getting stale and that changes in the content of the program was needed and (4) there was negative feedback from the girls that the Cargill processing plant was, "too hot and smelly".

BACKGROUND SUMMER 2009 PROGRAM

During the summer of 2008 the Herff College of engineering Director of Development, Carolyn Oldenburg, convinced Cargill to fund the GiM program for an additional two years which allowed the GiM program to advertise two sessions early in the marketing campaign for the summer of 2009. In addition, a graduate of our Engineering Technology program secured additional funding from her employer, Cummins, for the GiM program and a decision was made to have the girls tour the Cummins manufacturing plant. With those additional funds the faculty decided to add two additional student assistants to the program to reduce the workload during the program sessions. Additionally, a faculty member received a mini grant to purchase soldering stations for use in the Engineering Technology coursework. He was encouraged by his colleagues to build an electronics kit in the GiM program for summer 2009 and refine his soldering coursework for the upcoming fall 2009 classes. With the introduction of an additional faculty member and adding several hours of soldering, the Engineering Economics sessions were dropped because the responses from the girls had indicated that they all enjoyed the hands-on experiences and really enjoyed taking home the products of those experiences. With all of the above items accomplished, all of the major issues listed from the summer of 2008 were accomplished. Results from applications showed a reduction in the number of applicants and a decision was made to go back to the combined sessions rather than separating school class levels. The faculty members, due to the Cargill - "hot and smelly" complaints, worked with the engineering group at Cargill and modified the tour to not travel as much of the facility to minimize the odors.

RESULTS SUMMER 2009

The results from summer 2009 program mirrored the outcomes from the past summers. Adding the additional tour of Cummins added another manufacturing tour which also allowed the faculty to further discuss the lessons learned in the various daily sessions within GiM. However feedback from the student assistants gave the faculty several issues to solve: 1) the electronics kits needed to be reworked to speed up the soldering efforts and have better outcomes, 2) many of the kits needed reworking prior to the end of the week so that the girls would each have a working kit to take home.

BACKGROUND SUMMER 2010 PROGRAM

Another faculty member is applying for a mini-grant to promote robots within the Engineering Technology coursework. Like the previous summer mini-grant, he is being encouraged to develop a majority of his work by using the GiM program sessions. If successful, the new robotics portion will replace the older MicroBots sessions thus giving a new fresh feel for the robotics sessions and an additional faculty member for the summer program. Marketing has already begun which will hopefully bring the number of applicants back up to 2008 levels. One setback has taken place because the difficult economy caused Carrier to give a reduced annual grant for the GiM program.

Blueprint and Lessons Learned

The blueprint for the success of this program is evident by the continued applicants for the summer program:

1) It is a girls-only program
2) It is a structured program with rotating sessions and faculty members.
3) It takes willing faculty members, a committed Department Chair, and Dean to encourage this type of program.
4) It takes companies to sponsor the program and then have the companies see the results of the program through the plant tours and the luncheon presentations to the girls.
5) The programs continued success is based on continuous improvement and dialog with the companies, faculty, parents and girls of the GiM program.

CONCLUSION

The GiM program has been a success from the beginning. The program's continuous improvement dialog has caused the introduction of new, exciting changes in the program curriculum as well as opportunities for additional funding. The upcoming summer of 2010 is yet another chance to connect with high school girls and offer them the engineering problem solving viewpoints as well as the opportunities for women in engineering.

FINDINGS

Paraphrased are comments for the entering questionnaire and the exiting questionnaire:

Entering Questionnaire: What are the first two words that come to mind when you hear "engineer".

"To create something to enhance people's lives" , "designers" , "diligent (hard working) and serious" , "solve problems and creative" , "buildings and electronics", "buildings and robots".

Exiting Questionnaire: Are you more interested in a career in manufacturing engineering? Why?

"No, but I now really want to be a chemical engineer" , No, but I have more interest in being a biomedical engineer" (note, two female speakers were from local biomedical companies) , "Yes, I really enjoy the hands-on problem solving" , "Yes, because I like problem solving, want a great career and make a lot of money" , "No, the tours convinced me that I don't want to work in a plant" , "No, I really don't like manufacturing, I enjoyed robots but Mr. Banning told us that you have to 'love' what you do when you choose a careen and I don't 'love' manufacturing" , "no, this program confirmed that I really want to be a biomedical engineer" .

Exiting Questionnaire: Did you enjoy the girls-only approach of this program? Why?

"Yes, it allows focus and concentration for the participants" , "Yes, because it showed that women can be engineers" , Yes, because it allow us to see the girls point of view" , "Yes, it enhanced the importance of the opportunity for girls to get well paid in a male dominated field" , "Yes, I really feel satisfied because it made me feel confident, hopeful and proud of my feelings and opinions" , "Yes, I think that the approach takes a lot of pressure off of girls and allows them to focus more" .

REFERENCES

[1] Hewitt, Robert, "Applying the Key Findings of the EWEP Needs Assessment Final Report to a Single-Gender Outreach Program", *Proceedings of the American Society of Engineering Education South East Regional Conference, 2008*.

Thomas (Tom) Banning

The author earned an AAS Degree with a concentration in Computer Engineering Technology from State Technical Institute at Memphis, a BS Degree with a concentration in Industrial Technology from Southern Illinois University, and an MS Degree with a concentration in Computer Engineering Technology from The University of Memphis. His electronics experience includes 8 years of U.S. Navy service, as an instructor in U.S. Navy AV'B' school, 10 years of design and maintenance as an Electrical engineer for FedEx, 14 years of management in Facility Management for FedEx, 20 years as an adjunct professor for The University of Memphis and Southern Illinois University. He joined the faculty of The University of Memphis full-time in the summer of 2006 and is now an Assistant Professor for the Engineering Technology program.

Jerry Newman

The author earned an AAS Degree with a concentration in Electronic Technology from State Technical Institute at Memphis, a BS Degree with a concentration in Industrial Technology from Southern Illinois University, and an MS Degree with a concentration in Electronics Engineering Technology from The University of Memphis. His electronics experience includes 24 years of U.S. Navy service, as a training coordinator in an industrial engineering environment, and 11 years as a faculty member with both Central Texas College and Southwest Tennessee Community College. He joined The University of Memphis faculty full-time in the summer of 2006 and is now an Assistant Professor for the Engineering Technology program at The University of Memphis.