

## **2006-327: THE WORLD IMAGES OF SCIENCE & ENGINEERING (WISE WOMEN) PROGRAM**

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# **The World Images of Science and Engineering for Women Program (WISE Women) at Mississippi State University**

## **Abstract**

The World Images of Science and Engineering for Women (WISE Women) Program at Mississippi State University is a natural expansion of the K-12 outreach activities of the Bagley College of Engineering. Since 1990, with the cooperation of the local National Society of Black Engineers chapter, the college has sponsored the University Familiarization Program for Minorities in Engineering (UFPME) for rising ninth through eleventh graders. In addition, since 1994, along with the student section of the Society of Women Engineers, the college has hosted Women in Action, a program for rising seventh and eighth grade females. Over half of the participants in these two programs have pursued or are pursuing a degree in science or engineering.

Due to the success of both UFPME and Women in Action, the college realized the need for a program targeting past participants of Women in Action to continue their interest in science and engineering during high school. In 2001, the WISE Women program was introduced. It was modeled after the UFPME program, but shortened to one-week instead of two. Participants are introduced to the ten engineering disciplines offered at Mississippi State University. They also participate in hands-on activities, with two major project competitions that are completed throughout the week. Six to eight SWE student members act as counselors throughout the week and faculty conduct and assist with activities and tours.

Post-camp follow-up has shown that of the girls who are eligible to attend college, almost half are currently in college. Of those, most are in an engineering discipline. Several students' comments indicated they gained a better understanding of engineering and what it takes to become an engineer. One student, an eleventh grader during the 2001 WISE Women program stated, "The camp gave me a window to see what exactly each field of engineering did and how each field affects the daily lives of everyone around the world!" This student is now a senior in Aerospace Engineering at Mississippi State University.

## **Introduction**

To promote careers in science, mathematics, engineering, and technology among the youth of today, the Bagley College of Engineering at Mississippi State University has an innovative

outreach program that offers special activities, workshops, and projects throughout the year for students, teachers, and counselors in grades K-12. This program is designed to provide a continuum of programs for students at various stages in their educational development.

With the cooperation of the student chapter of the National Society of Black Engineers, the Bagley College of Engineering has sponsored a highly successful high school minority program since 1990. In fact, 51% of past participants are currently pursuing or have completed a degree in engineering. Of these, 75% are Mississippi State University students or alumni. Also, for the past eleven years the Bagley of Engineering along with the student section of the Society of Women Engineers has conducted a thriving junior high girls program. Post-camp surveys indicate 74% of participants would consider a career in engineering.

These programs have been successful in attracting women and African-Americans into the Bagley College of Engineering. In 2005, women comprised 18% of all engineering undergraduates while African-Americans were 11 % of the engineering undergraduate student body.

However, an overall review revealed the K-12 outreach program was missing an important component for high school girls. To fill this void, the first World Images of Science and Engineering for Women (WISE Women) program was introduced during the summer of 2001. The program endeavors to increase the number of female students who choose engineering as a career. Thirty girls participated in the one-week residential program for rising ninth, tenth, and eleventh grade female students. Since then, the program has continued each year with 30 students.

The program elements are modeled after successful activities from the two previously mentioned programs. Design and problem solving projects include: designing and making stationery from recycled materials; designing, building, and racing a mousetrap car; designing and building a prototype of a shoe; designing, building and breaking balsa bridges. Various departmental faculty members provide presentations on engineering principles behind the projects. In addition, participants tour several research facilities including: the Raspet Flight Research Laboratory, the Silicon Carbide Laboratory, and the High Voltage Laboratory.

## **Participant Selection**

To attend WISE Women, participants must have completed the ninth, tenth, or eleventh grade. A total of 30 girls are selected to attend. They must fill out an application that includes math and science activities, grade point average, ACT score, transcripts, teacher recommendations, and an essay. Most participants are from Mississippi, although there have been a few from other states in the region. Some participants know very little about engineering, while others know what engineering is in general, but not about the specific disciplines.

To advertise the program, letters are sent to every high school counselor or science department head in Mississippi. Applications are available on the website. Advertisements are also placed in state and local newspapers in the region.

Counselors are engineering majors and SWE members. Beginning in January, announcements are made at the monthly SWE meetings and through e-mail for any students interested in being the coordinator or a counselor. Candidates for coordinators and counselors are interviewed and chosen the beginning of May. Once a coordinator is chosen, it is her responsibility to create the schedule of activities and contact faculty members for tours. Once the schedule is finalized, the coordinator and counselors meet with the K-12 Outreach Coordinator to review the schedule and go over each activity. Both the coordinator and counselors are allowed to take one class for the five-week term and a schedule is worked out so each counselor gets an hour or two of study time each day to work on homework or just take a break. Payment for the coordinator and counselors includes a stipend and meals for the week. Lodging is included for the three counselors that stay in the dorm with the participants.

## **Activities**

Activities include hands-on activities, team competitions, and tours of the various engineering departments on campus. Additionally, the girls participate in two, week-long projects that are judged at the end of the week. Some of these activities are in disciplines such as civil, chemical, and general engineering.

Participants arrive on Sunday afternoon. After a brief orientation session with their parents, the girls are given a short overview of engineering and the specific engineering programs offered within the Bagley College of Engineering. The girls then begin some team-building activities,

one of which is building a roller coaster. In this activity, teams of four or five girls are given different lengths of pipe insulation cut in half, duct tape, and a couple of marbles. The concept of potential and kinetic energy is then explained. Then, in 20 minutes, the teams have to build a roller coaster using the materials given with at least one loop and two hills. The marble has to travel through the coaster without falling off. The girls not only learn basic concepts, they also realize the importance of teamwork and communication in engineering.

Beginning on Monday, the girls are introduced to their main projects for the week – balsa wood bridges and the Cinderella Project. The balsa bridge project is a basic bridge building project that incorporates civil engineering concepts along with materials and financial management. Teams of four are given a beginning amount of balsa wood. A basic presentation of types of bridges and constraints for the project are given to the participants. Each team must then begin designing their bridge. Once their bridge is designed and checked off by a counselor, the team can begin to build their bridge. Each team must pay for their glue and saw time. For each time increment, they must “pay” a certain amount of money to be taken into account at the end of the project. At the end of the week, the bridges are tested to see which will hold the most weight. Taking into account the weight each bridge held and the “cost” associated with it, awards for the best bridges are given out at the banquet.

The Cinderella Project is a general engineering project where the girls go through the entire engineering design process. They begin by learning about the biomechanics of the foot and the problems associated with women’s feet due to the type of shoes they wear. The girls are then divided into groups of two and are given the task of designing and building a prototype of a shoe that is sturdy, comfortable, and fashionable. They must try to “sell” their shoe to their fellow participants. Using this data, they must create a marketing plan and present it to a panel of judges.

When not working on their project, participants visit each engineering department. Faculty members give an overview of the department, usually followed by a tour of the labs or an activity. For example, a visit to Aerospace Engineering would entail an overview of what aerospace engineers do and the tours of the wind tunnel and Raspet Flight Research Laboratory. Another example would include a visit to Chemical Engineering where the participants would get an overview and then conduct an activity on the absorbency of diapers.

WISE Women ends on Saturday afternoon with a closing banquet. Participants and counselors are given shirts to wear and parents are invited to attend. The Cinderella Presentations are given again for the parents, along with a picture slideshow. Each participant is given a participation certificate and various other awards, such as best overall participant, best shoe design, etc., are given out.

### **Budget**

The budget for WISE Women totals about \$7,700. Because WISE Women is a residential program, housing and food are the main costs. Housing for 30 participants and 3 counselors for 6 nights is \$2,400. Participants and counselors are given a \$15 per day food allowance. Salaries for the counselors vary from \$300 for counselors who do not stay in the dorm to \$400 for those who do. The coordinator is paid \$500. Participants are required to pay a registration fee of \$100. A total summary of costs can be found in Figure 1.

<b>Item</b>	<b>Total Cost</b>
Housing	\$2,400.00
Food	\$3,000.00
Banquet	\$1,500.00
Salaries	\$2,200.00
T-shirts, lanyards, etc.	\$600.00
Supplies	\$1,000.00
Registration Fees	-\$3,000.00
<b>Total</b>	<b>\$7,700.00</b>

Figure 1. A summary of costs.

### **Results**

Each fall, a letter and survey is sent out to each past participant of all of the summer outreach programs of the Bagley College of Engineering. Post-WISE surveys have shown that sixty percent of those enrolled in undergraduate courses are in a science or engineering discipline, with the majority of those enrolled at Mississippi State University. For those still in high school, the question was asked what they would like to study in college. Of those that responded, almost 80% plan on majoring in science or engineering.

An unexpected outcome from the WISE Women program has been the continual perpetuation of interest and involvement on all levels. Students who have participated in WISE Women, while

pursuing engineering degrees at Mississippi State University, have become coordinators and counselors for the summer program. For example, for the past three years, the coordinator and at least one of the counselors were participants in the inaugural WISE Women program in 2001. All this goes to prove that engaging students early in the education process yields future engineering leaders prepared to meet the challenges of an ever-changing world.