The Women in Applied Science and Engineering Program: How Diversified Programming Increases Participation

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Abstract

Over the past seven years, the Women in Applied Sciences and Engineering (WISE) Program in the College of Engineering and Applied Sciences (CEAS) at Arizona State University (ASU) has developed successful retention programs increasing one-year retention rates by more than 8% since 1993. However, in the fall of 2000, only 113 of the 880 female undergraduate students were actively involved in WISE programs. By the fall of 2001, over 400 female students were actively involved, an increase of 254%! The drastic improvement in student involvement can be directly attributed to a diversity of programming provided for the first time since the WISE program’s inception. This vision was actualized by the hard work of a dedicated staff that has a goal of reaching 50% of all the undergraduate women in the CEAS at ASU by fall 2002, approximately 470-500 students. In addition, the student SWE organization sponsors activities for its membership.

The paper describes programs utilized prior to the fall of 2001 and the new programs added in fall 2001 which include: Wise Match, a program designed to pair lower division engineering students with upper division engineering students with a twist: activities such as scuba diving are linked to engineering; Study Groups facilitated by WISE staff members; the Women’s Wellness Series consisting of three workshops per semester and supported by the Southwest Institute of Healing; Community Service Programs including a Walk for Hope and a program in collaboration with Big Brothers/Big Sisters of Central Arizona; ArtVentures in Engineering, a collaborative partnership between the WISE Program and the Katherine K. Herberger College of Fine Arts at ASU; and WISE Engineering Residence Hall events.

By expanding the retention programs to include activities that involve engineering and are female focused, WISE has been able to increase participation dramatically.

I. Introduction

According to recent studies, female students encounter such barriers as lack of self-confidence, ineffective learning environments, lack of female role models in science-related fields, and
failure to recognize the relationship between science courses and societal expectations of women. Due to these factors, many female students dropout of engineering or choose to change their majors to other disciplines without seeking academic support. Therefore, there is a need for retention programs that establish an early support network for female students and act to foster personal relationships.

For students of either gender, major issues that impact first-year retention include difficulty in the transition from high school to college, financial problems, and general misinformation about the engineering curriculum. In addition, first-year engineering students generally have very little exposure to engineering. Academically, the first-year curriculum consists primarily of fundamental courses (physics, mathematics, chemistry, English, etc.) that are essential prerequisites to upper divisions engineering courses. Often, these courses fail to motivate students and many potential engineers transfer out of their majors before they experience any engineering. In either case, female students do not feel comfortable in their degree programs initially and feel a lack of contact with their college.

Therefore, it is necessary that retention efforts begin with programs that serve to integrate female students into the college, peer groups, and support services available to them. These programs should include both academic and community learning experiences that help female students to connect on a personal level with staff, faculty, and other female students in the college.

II. WISE Retention Programs

The WISE Office at ASU has had several retention programs in place that have aided the CEAS in increasing its retention rate for women by more than 8% from 1993 to 2000. These programs are still in place and include:

**WISE Member**
Any student, male or female, may become a WISE Member by filling out a form in the WISE Office. Membership is free, but a completed form is required with an email address and each member is assigned a password to use the computers in the WISE Center. WISE Members enjoy a number of benefits including use of the WISE Center, access to computers, information on scholarships, job opportunities, news on upcoming workshops, study space, free lockers for day use, a kitchen area for meals, couches for sleeping, and special events.

**Student Success Participant/Mentor**
The Student Success program is designed to meet the individual needs of students having academic difficulties or for students who wish to get a head-start on succeeding in their engineering curriculum. Goals of this program are to establish contact with at-risk female engineering students, to provide information on college and university resources, and to offer academic advisement to students. The primary purpose of the program is to improve students’ GPA in the current semester, retain students in engineering, and ensure students are achieving semester goals by maintaining personal contact. In addition, Student Success promotes the cultivation of mentoring relationships, increasing classroom success, seeking internship/co-op opportunities, and assisting in other factors that may influence the ASU engineering experience. As of fall 2001, every student success participant must also participate in the WISE Match
program outlined below. Reference 4 describes the Student Success program in more detail and was also nominated for outstanding ASEE paper.

**WISE Industry Network (WIN)**
WIN is a collaboration between Intel and WISE that provides female engineering students the opportunity to meet with engineers from local industry, facilitates networking, and prepares them for their future careers. WIN provides monthly networking meetings throughout the semester. Each meeting covers a different topic of discussion and includes a free lunch. Topics in the past have ranged from life/work balance for females in engineering to resume review workshops. This partnership is very popular with WISE students.

**Society of Women Engineers (SWE)**
SWE is a national organization striving to stimulate women to achieve their fullest potential in careers as engineers and leaders. In addition, SWE strives to expand the image of the engineering profession while demonstrating the value of diversity. Meetings are held twice a month for interested female engineering students. Each meeting has a corporate sponsor that facilitates a workshop or panel discussion. The student chapter at ASU has an office in the WISE Center and works very closely with WISE staff to collaborate on events.

**Coalition of Engineering Minority Societies & SWE (CEMSWE)**
WISE works closely with the Office of Minority Engineering Programs (OMEP) and CEMSWE, a collaboration of four student organizations including SWE, the Society of Hispanic Professional Engineers (SHPE), the National Society of Black Engineers (NSBE), and the American Indian Science and Engineering Society (AISES). The WISE and OMEP offices provide support for student events such as Diversity Evening with Industry, the CEMSWE Spring Banquet, and semi-annual CEMSWE Leadership Retreats. The WISE and OMEP Directors serve as advisors to CEMSWE.

**Seminars/Technical Workshops**
Each semester, WISE offers a seminar series on topics of special interest to female students. Seminars include workshops on developing effective study skills, time management, resume writing, and panel discussions by female engineers from local industry. WISE also provides a variety of technical workshops on topics such as Excel, Maple, and Matlab. This programming allows flexible and creative workshops as needed by students. For example, in the fall of 2001, WISE held two workshops in collaboration with ASU Counseling and Consultation on how to cope with the events of September 11, 2001.

**Summer Bridge Program**
The WISE Summer Bridge Program is an innovative approach to easing the transition from high school to college for incoming female freshman students. During this four day residential program, students participate in activities including academic reviews on MAT 270 (Calculus I), MAT 271 (Calculus II), PHY 121 (Physics I), and CHM 113 (Chemistry I) courses; preparation for ECE 194 (Introduction to Engineering) introductory labs; MAPLE programming sessions; student panels; and evening activities geared toward students networking with WISE staff and other students. The Bridge Program occurs each summer just prior to the beginning of the fall semester. Raytheon has sponsored the program for the past three years. Bridge students have a
higher one-year retention rate than non-bridge students, being retained at or above 80% for the last 3 years.

**Lab Instructors/Counselors**
During the WISE summer outreach programs to middle and high school females, undergraduate and graduate students are needed to serve as lab instructors and program counselors. Lab instructors and counselors work with the middle and high school students to guide them in team building activities and to introduce them to different fields of engineering. This is an excellent way for engineering students to earn summer money and to have fun. WISE employs between 20-30 additional students each summer, mostly women CEAS students who are WISE Members.

### III. New WISE Retention Programs

In addition to these highly successful programs, WISE has added several others that have contributed to the 254% increase in participation by female students in the WISE Program since fall 2000. These new programs include:

**WISE Match**
WISE Match is a program designed to pair lower division engineering students with upper division engineering students in the same engineering discipline. This program provides lower division students with the opportunity to learn from the experiences of upper division students in order to gain knowledge and advice on what to expect in their coursework. WISE Match students are introduced each fall at the WISE Match Fall Banquet. Further, throughout the semester, WISE Match holds engineering related social events such as the engineering of horseback riding and scuba diving. These have proven to be very popular and to provide students with a new perspective on creative and fun ways to use their education.

**Study Groups**
Students can take advantage of forming study groups in the WISE Center to help them succeed in their engineering courses. WISE organizes a select number of study groups to aid students in calculus, physics, and chemistry. Each group contains three to four female engineering students currently enrolled in core curriculum classes. This past year, as part of the Boeing sponsorship of the WISE Center for 2001, funds were provided to staff and to coordinate study groups.

**Community Service Programs**
In an effort to meet the mission of ASU to be the community university in Arizona, WISE developed a community service program for students and staff. This program allows engineering students and staff to use their skills and knowledge in Arizona communities to better the lives of low-income populations. Our goal is to graduate a well-rounded engineer who has a sense of community and a willingness to give back to the community upon employment. In the fall of 2001 the staff and students participated in the following two activities.

**Big Brothers/Big Sisters of Central Arizona**
The WISE program has recently developed a community service program with Big Brothers/Big Sisters. This is a pilot program for the fall semester 2001 and spring semester 2002. Both undergraduate and graduate female engineering students can become involved by pairing with a young girl and serving as a mentor or by tutoring students in after-school programs.
spring 2002, WISE is working with Laird Elementary School to provide tutoring and after-school activities to young under-represented women involving engineering, math, and science. While serving as a wonderful community service activity, the program also serves as a recruitment tool for the WISE summer programs.

**Walk for Hope**
The WISE Office coordinated a major fundraising effort for the fight against breast cancer in the fall of 2001. Over 25 students and staff participated in the five-mile Walk for Hope. WISE made pink reminder ribbons and sold them for $1.00 each prior to the event to cover registration fees. WISE sold enough ribbons to be a sponsor of the event and have its logo on the event tee shirts. In addition, staff and students raised over $1,700 for the event and had a great time.

**Women’s Wellness Series**
The WISE Office established a wellness program in the fall of 2001 consisting of three workshops per semester. For the fall of 2001, WISE held workshops on yoga, meditation, and nutrition. Staff worked with local individuals and the Southwest Institute of Healing Arts to facilitate the workshops. They were highly successful, with yoga being implemented on a bi-monthly basis due to high student demand.

**ArtVentures in Engineering (AVIE)**
ArtVentures in Engineering is a collaborative partnership between the WISE Office and the Katherine K. Herberger College of Fine Arts. This program aims to express and to explore engineering concepts through the artistic media of music, dance, theatre, and visual arts. AVIE is designed to bring art and engineering to the community in an environment that appeals to multicultural and intergenerational learning. Although in a pilot stage, there has been good student interest and input in developing this program with the first event to be held in the spring of 2002.

**WISE Engineering Residence Hall Events**
Each fall semester, WISE connects with freshman female students who live on the engineering floors in Manzanita Residence Hall. For fall 2001, special efforts were made with a residence hall visit to invite the freshmen women to attend the Breakfast with SWE event held at the beginning of the year. The purpose of the main residence hall event is to inform students of WISE events and programs and to help freshmen women get to know the WISE staff and program assistants. An increase in attendance by freshman women at the breakfast and other events was noticeable after the hall visits.

**WISE Center Renovations**
The WISE Center is a centrally located room in the main CEAS administration and classroom building, directly across the hall from the WISE Office. The Center is used for academic and social networking. It has been in existence for the past eight years, however in summer 2001, the center was renovated due to the gracious support of local industry and a dedicated staff. Renovations included new female-friendly furniture (including stylish purple couches, pillows, and rugs in both the Center and the Director’s office), plants, pictures, a new full-size refrigerator, two new computers, a scanner, and a color laser printer. The Center is a place where female students can gather to study, to take advantage of resources such as on-line computers, and to view job and scholarship listings and company profiles. The WISE Center
also has a library of reference materials, which are of particular interest to women. WISE events and seminars are held in this room and all interested students are invited to attend. The new look makes the Center and the Director’s Office look comfortable and supporting and students are more likely to come, to sit, and to talk to gain assistance with academic or personal matters.

IV. Program Strategies and Planning

Under the leadership of a new director, a dedicated staff held a comprehensive staff retreat in October of 2000. The staff outlined a two-year plan with goals and objectives to increase student involvement in WISE programs. They outlined an overall mission to include a strong community and diversified programming agenda with the goal of creating a more well rounded graduate. After compiling a comprehensive report, the staff began holding WISE Member forums in the spring of 2001 to discuss ideas and to receive student feedback. The member forums are held on a continual basis twice a semester to evaluate the success of the programs offered each semester. Next, the staff began fundraising to meet their objectives. They were able to secure all the necessary funding to begin center renovations, provide food for events through partnerships to sponsor events, and to support special speakers. By summer 2001, the staff had planned a comprehensive programming schedule for the fall 2001. The schedule is listed below under program components. Finally WISE completed the fall programming schedule that saw an increase of 254% in student participation in a four-month period.

V. Program Components

For the fall 2001, WISE piloted a rigorous retention schedule with 35 events held and 400+ student participants. The schedule for fall 2001 is listed below. A similar schedule is in place for spring 2002.

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
<th>Time</th>
<th>Location</th>
</tr>
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<tbody>
<tr>
<td>August 12 – 15</td>
<td>WISE Summer Bridge Program</td>
<td></td>
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<tr>
<td>Monday, August 20</td>
<td>Fall Semester Classes Begin</td>
<td></td>
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<tr>
<td>Friday, August 24</td>
<td>Breakfast with SWE</td>
<td>8:00 – 11:00am</td>
<td>WISE Center</td>
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<tr>
<td>Tuesday, August 28</td>
<td>SWE General Meeting</td>
<td>6:30pm</td>
<td>WISE Center</td>
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<tr>
<td>Wednesday, August 29</td>
<td>WISE Open House</td>
<td>10:00 – 2:00pm</td>
<td>WISE Center</td>
</tr>
<tr>
<td>Thursday, August 30</td>
<td>WISE Open House</td>
<td>10:00 – 2:00pm</td>
<td>WISE Center</td>
</tr>
<tr>
<td>Thursday, September 6</td>
<td>Big Sister Orientation Meeting</td>
<td>2:00 – 4:00pm</td>
<td>WISE Center</td>
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<tr>
<td>Friday, September 7</td>
<td>SWE Lock-In</td>
<td>6:30pm</td>
<td>WISE Center</td>
</tr>
<tr>
<td>Wednesday, Sept. 12</td>
<td>CEAS Awareness Day</td>
<td>8:00 – 2:00pm</td>
<td>Tyler Mall</td>
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<tr>
<td>Thursday, Sept. 13</td>
<td>WISE Match Opening Reception</td>
<td>3:00 – 5:00pm</td>
<td>WISE Center</td>
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<tr>
<td>Tuesday, September 18</td>
<td>SWE General Meeting</td>
<td>6:30pm</td>
<td>WISE Center</td>
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<tr>
<td>Thursday, September 20</td>
<td>Women’s Wellness – Yoga</td>
<td>2:00 – 4:00pm</td>
<td>WISE Center</td>
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<tr>
<td>Thursday, Sept. 20</td>
<td>Coping and Crisis after 9/11</td>
<td>2:00 p.m.</td>
<td>WISE Center</td>
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<tr>
<td>Tuesday, September 25</td>
<td>WIN Meeting – Economy</td>
<td>11:30 – 1:00</td>
<td>WISE Center</td>
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<tr>
<td>Wednesday, Sept. 26</td>
<td>WISE Member Forum</td>
<td>2:00pm</td>
<td>WISE Center</td>
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<tr>
<td>Monday, October 1</td>
<td>WISE Residence Hall Event</td>
<td>6:00p.m.</td>
<td>Manzanita Hall</td>
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<tr>
<td>Tuesday, October 2</td>
<td>Big Sister Orientation #2</td>
<td>2:00pm</td>
<td>WISE Center</td>
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<tr>
<td>Wednesday, October 3</td>
<td>Resume I Workshop</td>
<td>2:00 – 3:00pm</td>
<td>WISE Center</td>
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<tr>
<td>Friday, October 5</td>
<td>E - Conference (Recruitment)</td>
<td>all day</td>
<td>Tyler Mall</td>
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<tr>
<td>Sunday, October 7</td>
<td>Walk for Hope</td>
<td>all day</td>
<td>Phoenix Zoo</td>
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<tr>
<td>Tuesday, October 9</td>
<td>SWE General Meeting</td>
<td>6:30pm</td>
<td>WISE Center</td>
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Wednesday, October 10  
Resume – Industry Critiques  
2:00 – 5:00pm  
WISE Center
Tuesdays, October 16  
WIN Meeting – Interviewing  
11:30 – 1:00pm  
WISE Center
Tuesdays, October 16  
Women’s Wellness - Meditation  
3:00 – 5:00pm  
WISE Center
Wednesday, October 17  
WISE Match Social  
6:00 p.m.  
Off campus
Thursday, October 18  
Deadline for Resumes ~ DEWI  
5:00pm  
WISE Office
Tuesdays, October 23  
SWE General Meeting  
6:30pm  
WISE Center
Tuesdays, October 25  
Diversity Evening with Industry  
6:00 – 9:00pm  
TBA
Tuesdays, October 30  
E - Conference (Recruitment)  
11:30 – 1:30pm  
WISE Center
Fridays, November 2  
SWE General Meeting  
6:30pm  
WISE Center
Thursdays, November 8  
Women’s Wellness – Nutrition  
3:00 – 5:00pm  
WISE Center
Thursdays, November 13  
WIN Meeting – Work/Life Balance  
11:30 – 1:00pm  
WISE Center
Tuesdays, November 13  
SWE General Meeting  
6:30pm  
WISE Center
Thursdays, November 15  
WISE Member Forum  
11:00 – 12:00pm  
WISE Center
Tuesdays, December 4  
SWE General Meeting  
6:30pm  
WISE Center
Thursdays, December 6 – 12  
FINALS!!

V. Retention Programming Evaluation-WISE Member forums

WISE holds two member forums each semester to evaluate the progress for the new and continuing retention programs. This past fall feedback was positive. Students really enjoyed the wellness series, as well as the community service involvement. In addition, old favorites like the WIN series and WISE Seminars were popular as well. Students further greatly appreciated the improvements made to the WISE Center stating: “It feels like the College is taking us seriously and really supporting us.”

VI. Retention Results

The enrollment of women in college has been steadily increasing from 532 (16.8%) in fall 1991 to 940 (20.2%) in Fall 2001. The WISE Program was initiated in 1993. The University one-year retention goal for first-time freshmen is 78% by fall 2003. Freshmen women in the CEAS have been retained in the university for one year at over 78% for four of the last five years. In addition, the one-year retention of women within the CEAS is important. The 1998-2000 freshmen cohorts were retained on average at 61.9%, an increase of over 8% over the 1993-1995 freshmen cohorts, who were retained on average at 53.2%. Since the new programs described in this paper were piloted in fall 2001, the results of the retention efforts for the fall 2001 first-time freshmen women are not yet known. That information will become available in fall 2002 and will be evaluated at that time.

WISE will implement a comprehensive data tracking system in the spring of 2002. This system will integrate the demographics on all students attending WISE events into a database with other pertinent retention information to give a better understanding of the effects of WISE programming. This system can also be used to efficiently plan future programs.

VII. Serving as a Model

The WISE Program at ASU serves as a model to other programs throughout the nation. The WISE Office has published forty-five papers on their programs in the last nine years. The WISE staff regularly present at the Women in Engineering Program Advocate’s Network (WEPAN),
Frontiers in Education (FIE), and the American Society of Engineering Education. A very important factor in the major changes made in the WISE program in the past year is that the changes were made with no additional funding. The WISE staff simply evaluated and reorganized their current structure. Partnerships with other departments and community organizations have also helped to leverage resources and to provide for additional services. In fact, during this past year the WISE Office lost a soft money half time position, but due to a more effective program management style, that loss did not have an impact on the ability to deliver successful programs. The WISE staff has just completed another strategic planning retreat where current efforts were evaluated and discussed. A revised plan will be implemented in the fall of 2002, with an emphasis on furthering the current successful initiatives.

VIII. Conclusion

Although the results are preliminary, data received from the member forums indicate that the continuing and new WISE programs are effective. The WISE staff found the variety in programming created a well-rounded service center, more well rounded students, and more social and academic interactions between all students and staff. The WISE staff has been recognized for their innovation and dedication over the past year: all staff received Sun Awards, an ASU employee recognition; the Program Coordinator Senior was recognized as a student favorite employee by ASU; and the Director was nominated for the Supervisor of Year Award at ASU in 2001 and 2002. Further, in 2002, the Director was selected as a Supervisor of the Year by ASU. Moreover, the diversity in the programming has solidified the WISE program as one of the most dedicated and organized programs in the college, further boosting faculty and administrative support for women in engineering.

References

Biographies

DR. MARY R. ANDERSON-ROWLAND
Mary R. Anderson-Rowland is the Associate Dean of Student Affairs in the College of Engineering and Applied Sciences (CEAS) at ASU. Her Office is responsible for the recruitment, retention, and placement of CEAS students. Her responsibilities include Inclusive Learning Communities, the Women in Engineering Program, the Office of Minority Engineering Programs, Recruitment, the ASU GEM Program, and Student Organizations.

DANA C. NEWELL, M.A.
Dana C. Newell is the Director of the Women in applied Sciences and Engineering Program (WISE) at ASU. Her responsibilities include supervising staff who coordinate programs for summer and academic year recruitment and retention, fundraising and grant writing for program sustainability and expansion, creating new programs based on student need, and evaluating and assessing all functions of WISE.

SHAWNA L. FLETCHER
Shawna Fletcher holds B.S degrees in Physiological Psychology and Microbiology with a minor in Women's Studies from Arizona State University. She is a Program Coordinator, Senior in the WISE Office. Her primary responsibilities include coordinating retention programs for women in the CEAS. Shawna joined the WISE staff in May of 1997.