

The WISE Summer Bridge Program: Assessing Student Attrition, Retention, and Program Effectiveness

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Abstract

For participating university programs, summer bridge outreach has helped to significantly increase student retention in academic majors. For female engineering students, bridge programs not only serve an academic need, but also serve to foster networking relationships between students prior to starting the semester. The Women in Applied Science and Engineering (WISE) Summer Bridge Program was designed to prepare incoming female students for the transition from high school to the College of Engineering and Applied Sciences (CEAS). Since 1998, this program has offered academic reviews in courses such as mathematics, physics, and chemistry. In addition, computer-based curricula have been offered in Maple, Excel, and HTML to better prepare students for their freshmen introductory engineering courses.

During the Fall 2000 semester, summer bridge participants from 1998, 1999, and 2000 were surveyed on program effectiveness. Survey categories included general information, WISE Bridge experience, WISE services, and additional information. Survey results indicated that a significant number of respondents were first introduced to engineering by a family member and subsequently, enrolled in engineering because of a strong aptitude for math and science. Students indicated that the WISE Bridge Program, as well as other services offered in the CEAS and at ASU, aided them in their first semester. In addition, WISE program services such as academic advising, mentoring, and tutoring were also mentioned as significant in first semester retention of these students.

An overview of the WISE Summer Bridge Program will be presented as well as survey results from 1998, 1999, and 2000 participants. In addition, the paper will discuss the need for and impact of bridge programs specifically geared toward female engineering students as well as future projections of implementation and direction of student programs.

I. Introduction

Across the nation, academic institutions have found that summer bridge programs have helped to significantly increase student retention in engineering disciplines. Summer bridge programs specifically designed for female students not only serve to meet academic needs, but also serve to aid students in developing networking relationships and foster community building. Studies have indicated that obstacles women face in attaining engineering degrees may be categorized as both societal/cultural barriers as well as institutional¹. For many women, lack of information concerning the engineering curriculum and stereotypes that regard aptitude for math and science

as masculine inevitably deter females from pursuing engineering or technical degrees². Researchers have identified nine barriers to female enrollment in secondary level science, technology, and mathematics courses. 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 women³. 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 curriculum⁴. 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 engineering⁵. In either case, students are ultimately unaware of the academic demands associated with engineering and decide to transfer to other majors or drop out of college because they are unprepared for academic obstacles associated with these disciplines⁶.

Further, Seymore and Hewitt found little difference in high-school preparation, academic ability, or effort expended in coursework between students who continue with engineering and those who change their majors⁷. Many female students who pursued science or engineering degrees because of personal interest also indicated feelings of being forced to leave due to loss in confidence, difficulty with poor teaching, and inability to function in a highly competitive environment⁸. Therefore, it is necessary that retention efforts begin with programs that serve to bridge the gap between high school and college. These programs should include curricula that introduce the student to basic engineering concepts and directly expose them to the expectations of the college-level curriculum.

II. Bridge Program

The Women in Applied Sciences and Engineering (WISE) Summer Bridge Program in College of Engineering and Applied Sciences (CEAS) at Arizona State University (ASU) was designed to prepare incoming female students for the transition from high school to the CEAS. Since 1998, this program has offered academic reviews in courses such as mathematics, physics, and chemistry. In addition, computer-based curricula have been offered in Maple, Excel, and HTML to better prepare students for their freshmen introductory engineering courses. According to recent surveys and retention figures, students attending the WISE Summer Bridge are better able to acclimate to the campus by receiving general information concerning the university, financial aid, and departmental advising. In addition, students attending the program are able to become familiar with the campus, have a head start on all freshman engineering classes, and also have a chance to meet other female students within the college. Finally, the Bridge participants have become acquainted with WISE staff and a WISE room available for their support located directly across the hall from the WISE Office. Research has shown that a large cause of early attrition by

college students is that they have not had significant contact with a faculty or staff member in the first weeks of a semester⁹. The faculty or staff in many instances is able to encourage them or to help them cope with their challenges. The Bridge participants know several WISE staff quite well by the end of the program and know that the office is there to support and to help them.

III. Program Strategies

Since the first program in 1998, the WISE Summer Bridge has evolved in curricular as well as programmatic aspects. In designing an effective program, a great deal of emphasis was placed upon recruiting faculty and graduate students to teach review sessions in calculus, physics, and chemistry. In addition, faculty members were recruited to expose students to introductory engineering course concepts including Excel tutorial sessions and simple team-based projects. Students have reported a higher interest in their introductory engineering courses due to previous exposure to core concepts and faculty members. For the summer 2000 program, specific course elements were added that had not been included in previous years. Such elements included Maple programming sessions to prepare students for their introductory calculus course. Also, because starting college can be overwhelming, participants were given a comprehensive resource notebook that contained information on CEAS and ASU resources, including tutoring services, WISE services, and financial aid.

In addition to academic concerns, participants were able to address immediate social concerns with former bridge participants that served as counselors. Exposing these participants to upper division students, officers in the Society of Women Engineers (SWE) student organization, and women working in industry, gave bridge 2000 participants a vision that an engineering degree from ASU would be attainable. Throughout the program, continual emphasis was placed on the services WISE offers beginning in the first semester as well as forming initial contact with faculty, ASU resources, and other engineering students. Each Summer Bridge program was evaluated to measure its effectiveness and students were surveyed during and immediately following the program. The staff was also surveyed to attain a more complete picture of the success (or failure) of the program. Staff input was extremely valuable because all were female engineering students, some of whom had formerly participated in the bridge program and/or were currently serving as officers in SWE.

IV. Program Components

In 1998, fifteen students participated in the five-day commuter WISE Summer Bridge Program. All CEAS freshmen women (over 150) had been sent a letter of invitation to the Bridge Program. The program was held on campus during the five days before the beginning of Fall Orientation that runs during the week before the Fall Semester classes begin. The participants each paid a \$150 tuition fee. Scholarships are available for those who have financial need. This program offered academic reviews in mathematics, physics, and chemistry as well as computer program tutorials in Excel and HTML to better prepare students for their freshman engineering courses. General information about ASU, financial aid, and advising was disseminated to help students to become familiar with the campus. There were also evening activities planned that allowed participants to begin building a support system to utilize throughout their freshman year and beyond. In its first year, the National Science Foundation, through ASU's Foundation Coalition Program, funded the WISE Bridge.

In 1999, Raytheon sponsored the WISE Summer Bridge Program and made it financially possible for the programming to include a five-day residential program without an increase in the participant's tuition. This allowed incoming freshman women to experience dorm-life first hand. The four day program was attended by 43 freshmen women. The program was again held just preceding the Fall Orientation and included more formal team-building activities and engineering projects. By the end of the program, participants had created their own web pages. The Bridge Program closed with a reception and program including an audience of faculty, staff, and industry representatives.

In the summer of 2000, Raytheon once again sponsored the summer bridge. The program was offered as a four-day residential program, again just preceding the Fall Orientation. Twenty-seven entering freshmen CEAS women attended and were housed in a local motel. WISE staff members have concluded that numbers were down from previous years due to personnel changes within the WISE Office. Staffing was reduced and less effort was spent on recruitment. In addition, it can be difficult to get the student and her family committed to making the move to the campus five days before regular orientation programs begin. Housing on campus was not possible due to dormitory preparations for the fall. University faculty and staff taught the majority of the review sessions, which allowed the participants to interact with their future professors. The students were given a book on campus resources. Evening activities were planned with the SWE organization and industry professionals. All interactions with faculty, staff, and students added to the program to give students an understanding of what their experience at ASU would be like. The program closed with a luncheon in a local restaurant with some parents in attendance. Both staff and participants were surveyed immediately following the program to assess its value and to determine what improvements could be made in the future.

V. Survey Analysis & Results

Recently, the WISE staff surveyed participants from the three previous bridge programs in order to provide a more effective retention program. To date, only 17% of the 84 Bridge Program participants have responded, however these results show some interesting trends. As assessments of the programs are continued, the results of the survey have provided valuable insight into services that are successful in retaining freshman women in the CEAS at ASU. The survey was divided into four sections: General Information, WISE Bridge, WISE Services, and Additional Information. Survey results and conclusions drawn are provided for each section below.

General Information:

The General Information section sought to evaluate background information on participants and their general situation upon entering the CEAS. All of the respondents thus far stated that they learned about engineering for the first time from a family member. This result is in line with the results of the Cooper Union Survey of Women Engineers in which 52.6% of all women engineering students surveyed had a family member who is or was an engineer¹⁰. In addition, all of the respondents decided on engineering as a course of study between the ages of 13-17. More than 75% had not attended any prior middle school or high school programs before entering the WISE Summer Bridge Program. Further, most of the respondents cited choosing engineering as

a major because of the high demand for female engineers and an interest or strength in math and science.

Realizing that many factors contribute to the retention of any one student, the survey also aimed to create a general situational overview of each participant. The majority of the respondents were in-state students who lived on campus their first year. Since the Bridge program is held the week before the beginning of fall semester, many felt that the program gave them the opportunity to get acquainted with dorm life, the campus, and each other prior to starting coursework. This was rated as a highly valuable experience. However, there was some feedback from out-of-state students that having the program right before the semester was somewhat stressful.

In addition to the Bridge program, respondents reported other services both in the College or at ASU that aided them in their first semester. All of the students reported that the Summer Bridge program allowed them to meet other female engineers prior to starting classes and that made them feel more comfortable as the semester began. In addition, services such as academic advising, mentoring, and tutoring provided by the WISE program were cited as being significantly important in first semester retention.

WISE Bridge:

In the WISE Bridge section, the survey tool requested information on what is working in the actual week residential program and what additional services could be added to further aid in the transition from high school to college. All of the students who responded to the survey stated that the Summer Bridge Program was “very helpful” or “somewhat helpful”. When asked what they liked most about the program, the majority stated that getting to know the campus and each other was very helpful, as well as the math and science course reviews. When asked what additional services they would like to see in the future, the respondents suggested even more time to interact with each other socially, a full campus tour, time management training, and more specific information on individual majors and courses. The participants did not list any program items that should be eliminated.

WISE Services:

In the section of the survey pertaining to the WISE services provided for entering students outside of the Summer Bridge, all of the students reported having used at least one of the following services: seminar series, peer advising, meeting space, computer labs, or mentoring programming. One of the most valuable of those services was the Intel sponsored mentoring program. This program, WIN (WISE Industry Network), holds meetings once a month for interested female engineering students on topics ranging from interviewing skills and internship opportunities to how to balance life, work, and family. Professional women from throughout the Phoenix area come to campus and speak to small groups or one on one to students about the challenges of being female in the engineering arena. When asked what additional services they would like to see provided, not a single respondent listed needing any additional services.

Additional Information:

In the Additional Information section of the survey, less than half of the respondents were involved in a student organization. For those who were, they were mostly involved in the Society of Women Engineers. However, all of the respondents stated they would be interested in volunteering with the WISE Program to aid other incoming female students.

VIII Retention Results

The enrollment of women in the CEAS has been steadily increasing from 532 (16.8%) in Fall 1991 to 880 (20.7%) in Fall 2000¹¹. The WISE Program was initiated in 1993. The one-year retention of the WISE Bridge women in the CEAS was 80% for the 1998 Bridge Program year and 70% for the 1999 Bridge Program year. This contrasts with a comparable one-year retention rate of 60% for non-bridge participant women entering in the CEAS in the Falls of 1998 and 1999¹¹.

IX. Conclusion

Although the results are preliminary, data received from the survey indicate that previous WISE summer bridge programs are effective. The WISE staff found the Summer Bridge survey results extremely useful in assessing program effectiveness, student retention, and attrition. Initially, it was observed that all of the respondents decided on engineering in middle school or high school. This strengthens findings that indicate current recruitment programs, including middle school and high school programs provided by WISE each summer, are necessary and effective. Secondly, having a residential program proved to be a very valuable experience in lessening the stress of transitioning from high school to college. Based on preliminary results, it was determined that the bridge program was effective and useful to its participants. The results of the survey conclude there is a need for more social activities, time management training, individual major and coursework sessions, and a full campus tour. Funding for the continuation of the program through 2002 has been secured and WISE will continue to research student needs and program effectiveness and to improve the Summer Bridge program accordingly.

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