

From Email Mentoring to Networking: Preparing for the Future through a Spectrum of Women in Engineering and Science Programs

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Abstract—Over the past ten years, the Faculties of Engineering and Science have developed a number of programs to attract and support women students, faculty and professionals in the fields of science and engineering. These initiatives are aimed to educate, support and excite women of all ages about the variety of opportunities available to them in these fields. Programs are in place for female elementary, junior and senior high school students, undergraduate and graduate university students and practicing scientists and engineers. It is with these initiatives that the University of Calgary has played an integral part in helping to increase the number of individuals with science and technology backgrounds. This paper gives an overview of these programs including infrastructure, impact and provide numerical information about the number of women at the undergraduate, graduate and faculty level in science and engineering.

Index Terms – Engineering, Mentoring, Outreach, Science, Women

INTRODUCTION AND BACKGROUND

The University of Calgary has been active in the attraction and retention of women in science and engineering since 1990 and these efforts are providing significant benefits today with respect to the participation of women in these programs. The strong commitment to women in science and engineering has its roots in the need to encourage both women and men to pursue these fields, not only because increased diversity is linked to stronger organizational performance, but that it is imperative for educational institutions to break down societal stereotypes by providing information and encouragement to all potential students, regardless of gender. This is particularly important for a community like Calgary which is economically driven by science and technology to the extent that it has the largest concentration of engineers per capita compared to any other

Canadian city. It was felt that since Calgary is a leader in science- and engineering-based industries, the respective faculties at the University of Calgary must be leaders in recruiting a diverse student base so employers could be competitive in the global marketplace.

The launch of the Women in Science and Engineering (WISE) student club in 1990 was one of the initial catalysts that gave an institutional focus to women in science and engineering issues. With strong support from the Deans and individual faculty members, the club has grown in size and stature and is the second largest student club on campus. Another initiative that solidified WISE activities was the creation of advisory committees on women in engineering, and women in science by the Deans of the two respective faculties. These forums provide a mechanism for ongoing activities to be developed, particularly in the creation of new outreach programs, and they also provide the Deans with a direct link to important issues and concerns.

Work in the two faculties was further enhanced in 1997 with the creation of a Chair for Women in Science and Engineering. Initiated by the Natural Sciences and Engineering Research Council of Canada (NSERC), and financially sponsored by NSERC and Petro-Canada, the University of Calgary hosted one of the five regional Chairs who spent 50% of her time dedicated to WISE issues, with the remaining time spent on her academic research and teaching. The NSERC/Petro-Canada Chair was involved in three key activities including raising public awareness, conducting research into WISE issues, and developing new programs to increase the participation of women in these programs. The research, conducted with colleagues in Education and Sociology, provided an invaluable learning environment from which innovative programs could be developed. Two of these are the Explore IT conference for grade 9 girls and the SCiberMENTOR email mentoring program for girls aged 11 to 18. The Chair concluded in June, 2002 after which a WISE Coordinator was hired to

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continue and build on the work done during the Chair period.

The Faculty of Engineering has strongly supported initiatives with respect to women in engineering for over a decade. The central thesis for that support has been that society needs men and women to work together on engineering projects. To that end the Faculty of Engineering has led the way by initiating programs from the junior high school level all the way to industry to attract women into undergraduate and postgraduate engineering programs as well as academic positions. Over the period of about a decade the Faculty of Engineering has increased the number of full time female academic staff from 2 to 20 which is the highest in the country. These role models have in turn helped enrollment of women in PhD programs to significantly increase to 20.9%. Enrollment in undergraduate and masters programs are also at 27.4 %.

The Faculty of Science has also recognized the importance of diversity with a 43% increase in the number of academic positions being held by women (in the last 5 years the number of women has gone from 17 to 30). Enrollment in undergraduate programs is at 43% with Masters and PhD at 40.5 and 35.8%, respectively.

These results are driven by a comprehensive WISE program which ranges from K-12 outreach to ongoing support of women faculty. As a result, the Faculties of Science and Engineering can attract top class female students as well as female academics thus propelling them to the forefront of engineering and science education. This paper provides an overview of these programs and the benefits that are resulting in terms of increased participation and broader community impact.

PROGRAMS AND INITIATIVES

SCiBerMENTOR

The SCiBerMENTOR program matches Alberta girls aged 11 to 18 with women studying science or engineering at post-secondary institutions or with women practicing scientists or engineers in a one-on-one email mentoring relationship. It is a collaborative effort between the University of Calgary, the University of Alberta and the Alberta Women's Science Network and is funded by the Alberta government and EnCana Corporation. Started in 2001, the program is in its second year of operation and there are currently over 350 mentee/mentor pairs. The main objectives of the program are to expose young women to science and engineering career paths, to increase the retention rate of young women in high school math and science courses, and to increase the representation of women in science and engineering programs at post-secondary institutions. Based on previous research, email has been

shown to be an effective tool to reach out to young women and to have an impact in rural areas which traditionally lack role models for science and engineering careers [1]. The mentees are matched with mentors based on career interests and hobbies for a ten month period during which it is expected that they communicate using email at least ten minutes per week.

Since this is a unique mentoring program, several issues had to be addressed to ensure that the program would be successful. Communications materials, such as posters, were developed to advertise the program and targeted recruitment strategies were implemented. Significant effort was put into the mentee/mentor matching protocol as well as data security issues. Support structures and training programs were also developed including a website (www.scibermentor.ca), mentor and mentee program booklets that provide strategies for successful mentoring, a regular e-newsletter as well as discussion topics that are sent out on a monthly basis.

Results from an evaluation after the first year of operation indicate that the program is meeting the needs of both mentors and mentees. In particular, the results show that the program is being effective in maintaining the mentees' interests in math and science and that the mentors feel strongly that are making an impact on their mentees.

As seen in Figure 1, the majority of mentors are engineers (49%), followed by health scientists (28%). As the program grows the Program Administrators will continue to recruit mentors from all areas to be able to offer greater matching flexibility.

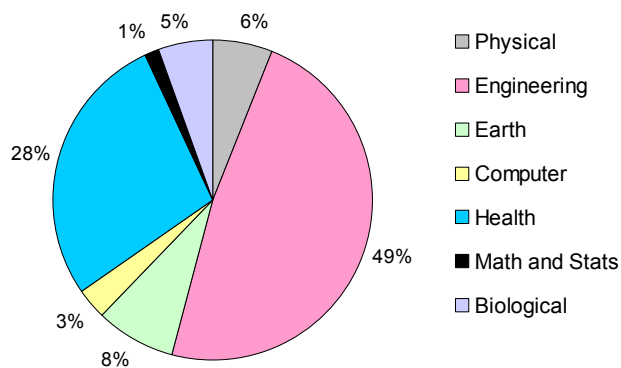


FIGURE 1: DISTRIBUTION OF MENTORS BY AREAS OF EXPERTISE

The program also encompasses a research program to assess the overall effectiveness of the email mentoring model to meet the program objectives. This research program entails

written questionnaires for the mentees as well as telephone interviews for both mentors and mentees.

Explore IT

Explore IT is a one-day hands-on conference for grade nine girls that began in 1999 in Calgary by a consortium of post-secondary institutions, industry, local school boards and government agencies. The University of Calgary was one of the two institutions that hosted the girls for the day and this has expanded to three institutions throughout the city. The main objectives of the conference are two-fold. The first is to provide an opportunity to intervene in grade nine before girls potentially limit themselves by eliminating science and math from their curriculum choices by realizing the importance of these subjects; especially for education within the ICT (Information and Communications Technology) sector. The second is to increase girls' awareness of opportunities and excite them about the possibilities available within the information and communications technologies sector.

The two largest school boards in the Calgary region have become strong supporters of the conference, both in terms of promoting the conference to their constituents, and in providing resources to teachers and schools in aid of their participation in the conference.

Girls register on-line through the conference web page (www.explore-it.org). They select the sessions that they would like to attend and can also find out more about the conference, sponsors, and links to other interesting science and technology web pages.

The conference begins with the registration of 500 girls at the three institutions and is followed by keynote speeches from leading women in the ICT field. These role models give the girls some perspectives as to the opportunities and pathways for their future careers. Throughout the day, the girls participate in two hands-on sessions in areas such as multimedia, networking, cinema, television, Java programming, robotics, satellite navigation, and web page design (see Figure 2). Lastly, the girls participate in a career choices workshop which provides them with the necessary information about pursuing a career in the ICT field.

Since its inception, Explore IT has impacted over 700 girls and almost 300 teachers from 100 junior high schools. A summary of the evaluations revealed that from the 289 returned evaluations; the girls ranked the experience a 4.48 on a scale of 1 to 5, with 1 being low and 5 being high. Furthermore, approximately 80% of the participants described a positive change in their attitude towards computers and careers with computers as a result of their attendance at the conference. The response to questions relating to "considering a career in the IT sector" pre- and

post-conference increased from 36%, to an overwhelming 81% who were subsequently considering a career in the IT sector.

Women in Engineering Day

Women in Engineering Day is an annual one-day event which gives young women in grades 10 and 11 the opportunity to meet female faculty and students at the University of Calgary and to engage in hands-on engineering related activities, tours and speeches by role models (see Figure 3). The main objectives of the program are to help the young women feel comfortable in an engineering environment and interact with undergraduate and graduate students, as well as faculty members in engineering in order to introduce the girls to the many careers available to them in engineering. The second is to inform the girls about high school courses and grades needed for entrance into an engineering program. The purpose of the event is to increase the enrolment of women high school students in undergraduate engineering education at the University of Calgary.

Approximately 150 grade 10 and 11 students and 30 teachers from in and around Calgary attend Women in Engineering Day each year. To date approximately 600 girls have participated in Women in Engineering Day.

In 2000, the Canadian Engineering Memorial Foundation (CEMF), which was founded in 1989 in memory of the victims of the tragedy at École Polytechnique, recognized Women in Engineering Day by awarding the event with the Engineering Students' Project Award.



In 1999, 136 girls participated in Women in Engineering Day, with 86 of them being Grade 11 or Grade 12 students at the time, which means that in the fall of 2000 they would typically be eligible to enter a post-secondary institution. A total of 65 (76%) are currently registered at the University of Calgary. Of this group at the University of Calgary, 47 (72%) are registered in the Faculties of Science or Engineering, with twenty (31%) specifically registered in engineering.

A summary of the 2002 evaluations revealed that from the 88 returned the girls ranked the experience a 4.52 on a scale of 1 to 5, with 1 being low and 5 being high. Furthermore, only 8% of the participants admitted to knowing a lot about engineering before the event. The most interesting responses were to questions relating to “considering a career in engineering” pre- and post-event rose significantly from 12% to 70%.

Meet the Dean

New women students who enter the Faculty of Engineering are invited to attend a reception at the start of the fall term. This evening is special to the Faculty because it provides an opportunity for incoming female engineering students to become aware of the many programs and services available to them throughout their academic careers.

About 100 first year women students are given a special welcome by the Dean and are introduced to the Chair of the Gender and Diversity in Engineering Committee (GDEC), the WISE Coordinator and the executive members of the WISE undergraduate student club. In addition, a number of female faculty members and other undergraduate students are present to welcome the first year students and answer questions throughout the evening.

Overall this event is a very fun and informal way to welcome first year female students to the faculty and it is the hope that each student leaves with the feeling that they belong to a faculty that encourages and promotes the success of women in engineering!

WISE Undergraduate Student Club

Once young women enter the post secondary environment they are encouraged to participate in the WISE undergraduate student club. Many innovative and useful activities are organized by WISE, which encourages and builds confidence in the substantial female undergraduate population. Created in 1990 as a support group for women in science and engineering, WISE has grown to over 1200 female and male members since the beginning, making it one of the largest student governed clubs at the University of Calgary. Recognized in 1992, 1999 and 2000 with the Students' Union Achievement Award (given to the most

active club on campus) the club provides a variety of services to the undergraduate student body. The goals of WISE are to provide support to all students, female and male, at the undergraduate level by providing them with tutorials for challenging science and engineering courses, guest speakers and tours of industrial companies. It is interesting to note that men make up a large minority of the club's membership and are also able to benefit from the variety of activities and services offered by WISE.



FIGURE 3: GIRLS PARTICIPATE IN HANDS ON DESIGN COMPETITION IN WOMEN IN ENGINEERING DAY.

Graduate Student Networks

Students entering graduate programs in science and engineering are encouraged to participate in either the Science or Engineering Graduate Student Network. These networks provide female students in science and engineering with the opportunity to meet other women graduate students and to provide information on topics relevant to them that might not be provided in any other forum. This is particularly important for graduate students in a research environment since their networks may be more diffuse compared to when they were undergraduate students.

Every month approximately 40 students from each faculty gather to listen to guest speakers, participate in panel discussions or to socialize. Each network elects its own chair who, with support from the WISE Coordinator, is responsible for the creation and implementation of monthly events. In addition, the graduate student networks act as mentors to members of the undergraduate WISE student club and answer questions about graduate programs and work-life balance. Examples of meeting topics are given in Table 1.

TABLE 1: SAMPLE TOPICS FOR WOMEN GRADUATE STUDENTS NETWORK MEETINGS

<i>Sample Topic</i>
<i>Myers-Briggs Personality Type Indicator:</i> information on how our temperament can affect our interaction with others, and our team-building ability.
<i>Roundtable discussion with the Dean of Engineering:</i> allows the graduate students to provide the Dean with information on how to improve the environment for graduate women students in the Faculty of Engineering.
<i>Women in Academia Panel:</i> women from various science and backgrounds spoke to the network about what can be done with a graduate degree.
<i>Women in Alternative/International Careers:</i> women from outside of academia as well individuals who have worked overseas speak to the network about the variety of opportunities available outside of academia.

OTHER INITIATIVES

In June, 1999 the Faculty of Engineering was recognized for the significant improvement it has made in creating a positive climate for women engineering students and faculty members with the first ever women friendly award for "Most Improved Environment" awarded by the CEMF.

In addition, in 1999 the Faculty of Engineering was the recipient of the CEMF's Dean's Millennium Award. This award had the goal of establishing a unique venue for communication and discussion of the implications of the École Polytechnique tragedy. The competition was open to Faculties of Engineering at all accredited Canadian universities.

Under the lead of the Gender and Diversity in Engineering Committee (GDEC), student and faculty teams were tasked with the design of all projects while engaging in the full engineering process including budgeting, construction, installation and utilization. The student team created a memorial bench with each of the 14 women's name as a part of the tabletop.

The overall goal of the "Bench" project was to learn from the tragedy by creating a unique venue for communication and discussion. In order to meet this goal, a team of dedicated students, faculty and staff members came together to design and construct a table and seating area that is both functional and pleasing to the eye (see Figure 4).

As part of an effort to continually improve the quality of our graduates and to modernize the program so that it appeals to men and women alike, the Faculty of Engineering

introduced a first year design course which provides students with the knowledge and skills that will serve them after graduation. This experimental learning style should be very attractive to women students as they are able to collaborate and problem-solve in group environments on real life projects.

In order to address the retention issue, both faculties created committees with the purpose of advising each Dean on women's issues. In 1994 the Women in Engineering Committee was developed as an ad-hoc committee of the Faculty of Engineering (later renamed GDEC) and elevated to Standing Committee status) and in 1999 the Faculty of Science created the Dean's Advisory Committee on Women's Issues (DACWI).

The role of each committee is to increase the numbers of women graduating from the Faculties of Engineering and Science by creating an inclusive and supportive environment which recognizes and values gender and diversity in general.

Members of the committees usually include faculty members (usually one male and one female) from each department, a graduate student representative, an undergraduate representative from WISE, and the WISE Coordinator.

The initiatives of both committees include but are not limited to: reviewing faculty promotion material for gender or diversity sensitive content and advising the Dean on implementing proactive strategies for gender and diversity practices.

WISE Coordinator

The University has recently appointed a WISE Coordinator who is responsible for the operation of existing initiatives as well as leading the organization in the development and implementation of new programs. Specific roles of the WISE Coordinator are: to provide support to the GDEC and DACWI committees which entail organizational support and program development, support of the graduate students networking groups, organization of Explore IT, Meet the Dean and Women in Engineering Day, to provide logistical support to student groups, to develop new initiatives and to liaise with women in the science and engineering research community and provide support where appropriate.

It is the hope of both faculties that this position will help lead the institution to further success in recruiting, retaining and attracting women into the fields of science and engineering.

CONCLUSIONS

The Faculties of Engineering and Science are recognized leaders in the development of programs to attract and



FIGURE 4: AWARD WINNING MEMORIAL BENCH.

support women students. These award winning programs have been developed in order to educate and support women students of all ages about the variety of opportunities available to them in the fields of science and engineering.

With at least four areas of academic life that are of relevance to the Faculty of Science and Engineering (pre-university students, undergraduate students, graduate students (and postdoctoral fellows) and faculty members, there are many challenges presented at each level in terms of full participation of women. With programs in place for female elementary, junior and senior high school students, undergraduate and graduate university students and practicing scientists and engineering, the University of Calgary has and hopes to continue playing an integral part in helping to increase the number of individuals with science and technology backgrounds in Alberta.

REFERENCES

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