

Women in Science and Engineering Activities at the University of Calgary

In 1997 the Natural Sciences and Engineering Research Council of Canada (NSERC), along with industrial and university support, created five regional Chairs for Women in Science and Engineering (WISE) to multiply efforts and increase visibility on issues pertaining to the attraction, retention and promotion of women in science and engineering fields. In addition to their professorial roles in science and engineering teaching and research, the five Chairs provide a strong voice on women in science and engineering issues from coast to coast. They are all involved in raising public awareness with respect to these issues as well as furthering society's knowledge by conducting collaborative and focused research. In addition, they are coordinating the development of targeted programs to address the low representation of women through the Chairs and in cooperation with other groups.

Dr. Elizabeth Cannon, a Professor in the Department of Geomatics Engineering at the University of Calgary, holds the NSERC/Petro-Canada Chair for Women in Science and Engineering (Prairie Region). Although her five-year mandate is to encourage women to consider careers in all aspects of engineering and science, she places a special emphasis on the attraction to the geomatics field. The five broad objectives of her Chair are to:

- (1) Be visible and show leadership;
- (2) Provide a focal point for diverse groups working on women's issues in science and engineering;
- (3) Interest and encourage girls and women to consider careers in science and engineering;
- (4) Increase the enrollment of women in undergraduate and graduate programs in science and engineering in the Prairie Provinces, and;
- (5) Increase the retention rate of women in science and engineering careers.



Girls learning about Geospatial Information Systems (GIS) at the annual Explore IT Conference at the University of Calgary

An Advisory Council consisting of twenty-two members from academia, industry, and government was formed to develop the strategic direction of the Chair and to help disseminate information to the community at large. The activities of the Chair broadly fit into two categories, namely public awareness and program development. A third category on research was also added since there is not a full understanding of issues surrounding these goals. These three areas are intertwined and are used to direct work done in each area.

Creating Public Awareness

During the past 48 months, the Chair has given over 150 presentations to a number of groups including students (and teachers), community groups as well as industry and political leaders. In general, these presentations have consisted of specific presentations on the role of women in science and engineering, while others have been on engineering as a career or the Chair's research work in the area of the Global Positioning System (GPS). For the case of women in science and engineering, a total of 60 vu-graphs have been developed. An important component of the presentation material is up-to-date statistical information on the participation and performance of females in science and math courses (in Junior and Senior High Schools), the enrollment of women in university-based programs (undergraduate and graduate levels), the participation, promotion and retention of women in indus-

try, and results from research conducted by the Chair and others. It has been found that this type of information is critical to dispelling myths surrounding the participation of women in science and engineering, while gaining support for action. Over 8,000 people have attended presentations by the Chair to date. A web page (www.geomatics.ucalgary.ca/cwse) has been developed containing information on the Chair goals and activities as well as statistical information discussed above, links to other relevant sites and a bibliographic database on women in science and engineering research.

Research

Research is being carried out in three areas identified as priorities, namely at the junior/senior high school level, university level, and pertaining to retention in industry. Two of these research projects are being conducted by the Chair with colleagues, and the third on retention is being done by Dr. Gillian Ranson in the Department of Sociology, with support from the Chair.

A research project entitled *Gender Differences in Student Participation and Achievement in the Sciences: Choice or Chance?* commenced in January, 1999 with collaboration between the Chair and Dr. Judy Lupart from Educational Psychology. The three-year project has the following objectives:

- (i) To investigate the key personal and educational factors that contribute to

junior and senior high school participation and high achievement in the sciences for males and females;

- (ii) To identify the factors that most directly contribute to decisions on the part of males and particularly females to pursue programs and careers in science and related disciplines;
- (iii) To explore roots of differences and similarities for males and females in early decisions about adult life-role and career choices, and;
- (iv) To investigate parent/teacher/counselor influence on student participation in the sciences.

The first phase of the study consisted of surveying over of 1400 boys and girls in grades 7 and 10 in Calgary. Although analysis is ongoing, some initial findings are very interesting. In particular, we see that girls are very interested in challenging careers and fully expect to go on to post-secondary education. However, when looking at career choices, areas that allow them to contribute to the world around them are very important. They are also very interested in careers that involve creativity. This means that when talking about science-based futures, we must show the link between the career and benefits to society, as well as emphasizing the creative aspects of science careers.

The second phase of the research project is currently being done whereby a subsample of 100 average and high-average ability students have been identified and are being tracked over a two year period. These students, along with their parents, are participating in in-depth interviews to determine how their perception of science and math changes over time. Teachers and guidance counselors are also being surveyed.

A second research project entitled Gender Differences in Academic Choices of Engineering Undergraduates began in April, 1998 was recently completed with collaboration from colleagues in the Department of Sociology. The project objectives were to determine the key influencing factors for women and men to select engineering as a major in their university undergraduate program; and to further determine the factors for selection of an engineering specialization (i.e. geomatics versus civil engineering). A survey was developed and administered to 1066 men

and women undergraduate engineering students at the University of Calgary in October, 1998. The survey was conducted during class time (taking approximately 20 minutes). A detailed sampling protocol was developed in order to have a sufficient representation from all disciplines (e.g. electrical, mechanical) and all years of study. The questionnaire contained a number of questions relating to the students' interest, performance and perceived abilities in High School and University courses, the positive (and negative) factors that influenced them to select engineering, and factors that influenced their decision to select their engineering specialization.

A major finding of the study is that male and female engineering students are generally similar in terms of their academic performance, interests and perceived abilities in engineering and related subjects, and in their perceptions regarding the characteristics that make engineers successful. One area of concern is the role of high school physics for female students, because they reported significantly less interest and perceived ability, but similar performance levels, compared to male students. This pattern appears to carry over to the university level where female students also report significantly less interest and perceived ability in physics than their male counterparts.

Family members were found to play an important role in influencing students' decisions to major in engineering. This suggests that it is imperative to have outreach programs that are aimed at, or include, parents since they form an important positive component in students' overall decision-making process. Results show that half of the engineering students have a parent or other family member who is or was an engineer. Male and female students who had mothers or fathers who were in engineering were more likely to receive

encouragement from their parents to select engineering compared to those who did not have a parent in engineering.

Selection of an engineering department is mainly driven by students' interest in the subject and career goals. There are relatively low representations of women in expanding disciplines, namely electrical and computer engineering. The findings suggest that many women are not interested in these areas or they do not see a fit between these specializations and their future career goals. Programs that show the practical applications of these fields are recommended to help develop a broader interest in these specializations. Students who selected geomatics as a department, were particularly interested in the career opportunities that it had to offer. This means that it is imperative for educational institutions offering geomatics programs to work closely with industry so that the career opportunities are fully known to potential students.



Grade 9 girls learning about GPS during the Explore IT Conference at the University of Calgary

Program Development

A number of programs are being piloted to assist in the promotion and retention of women students in science and engineering undergraduate and graduate programs. These include a Graduate Student Networking Group for women graduate students to provide the opportunity to meet each other as well as women who are leading successful careers after obtaining a graduate degree. The Graduate Education Opportunities Program was developed to expose undergraduate women students to graduate studies opportunities.

Other programs that have been developed with colleagues in the Faculty include the Women in Engineering Day where approximately 140 Grade 10 and 11

female students are invited to the University to learn about engineering, to participate in hands-on activities and to meet practicing women engineers and faculty members, (2) the Women in Engineering Breakfast which brings together about 75 men and women from the engineering community for an update on the Chair activities as well as a presentation by a prominent woman engineer, and (3) 'Meet the Dean' night where women students entering the Faculty are invited to meet each other, Faculty members and the Dean of Engineering.'

Two other exciting programs are being offered including one called Explore IT which is a collaboration between the U of C, other educational institutions in Calgary as well as government and industry part-

ners. This is a one day conference that brings over 300 grade 9 girls to the educational institutions for a day of hands-on Information Technology (IT) activities. Included in these activities are geomatics components such as GPS orienteering and GIS. This conference has proven to be very successful in terms of drawing the girls' attention to emerging career options, especially given that they get to experience these areas by actually doing the activities in a hands-on and fun way.

The final program that will be launched this fall is SCIBerMENTOR, which is an email mentoring program for girls aged 11 to 18. The girls will be mentored by women studying science and engineering at post-secondary institutions as well as women practicing these careers. It will be a one-on-one mentoring opportunity by email, which is a very comfortable means of communication for girls. It has been funded by Alberta Innovation and Science and PanCanadian for a three year period and is targeted at Alberta girls during this time. SCIBerMENTOR is being led by the Chair for Women in Science and Engineering (Prairie Region) in collaboration with the University of Alberta and the Alberta Women's Science Network.

Summary

The impact of the Chair at the University of Calgary will not be measurable for another few years, but to date there has been an increase in the representation of women in the first year engineering program to 24% which is one of the highest in Canada. In addition, the enrolment of women in geomatics (which is entered in second year engineering) has reached 26% from previous levels of about 9% ten years ago.

For more information on the Chair for Women in Science and Engineering, please contact Dr. Elizabeth Cannon at:

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**For information on the
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visit:**

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