

RECRUITMENT AND RETENTION PROGRAMMES TO INCREASE DIVERSITY IN ENGINEERING

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Abstract ^¾ Since 1989, the Women in Engineering Committee at Ryerson University has been developing strategies to increase the participation rate of young women in engineering at Ryerson. Programmes run by the Women in Engineering Office include both outreach aimed at pre-university students (recruitment) and support for the women currently enrolled at Ryerson (retention). Since the programme's inception, the percentage of women enrolled in Ryerson's engineering programmes has more than doubled, from less than 8% to over 16%. In addition, Ryerson's retention rate for female students is over 70%, which compares favourably to the national average of 60%-75%. This paper describes the activities that have been effective in recruiting and retaining women in Ryerson's engineering programmes.

Index Terms ^¾ Diversity, outreach, recruitment and retention, women in engineering.

INTRODUCTION

In the early 1980's, women made up roughly half of all graduates with bachelor's degrees, and by 1995 women accounted for 60% of all graduates. Although representation of women increased in all fields (social sciences & humanities, pure sciences, applied sciences, and engineering) nowhere was it more pronounced than in engineering, where the percentage of female graduates more than doubled between 1982 and 1995 [1]. However, even with increases continuing through the 1990's, women still account for only 20% of students enrolled in engineering programmes [2].

The Canadian Council of Professional Engineers (CCPE) has recently developed a policy on Women in Engineering which includes "Participation in the Formation of an Engineer: diverse participation in engineering strengthens the engineering profession, which includes making kindergarten to grade 12 female students aware of engineering as a career option and encouraging gender balanced application and enrolment into both undergraduate and postgraduate engineering programs" [3,4].

Since 1989, the Women in Engineering Committee at Ryerson University has been developing strategies to increase the participation rate of young women in engineering at Ryerson. Programmes run by the Women in

Engineering Office include both outreach aimed at pre-university students (recruitment) and support for the women currently enrolled at Ryerson (retention). Since the programme's inception, the percentage of women enrolled in Ryerson's engineering programmes has more than doubled, from less than 8% to over 16% (Figure 1) [5,6]. In addition, Ryerson's retention rate for female students is over 70%, which compares favourably to the national average of 60%-75%.

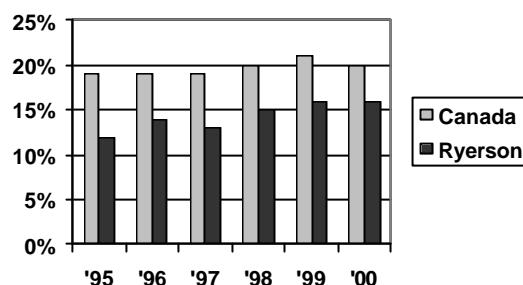


FIGURE 1
PERCENTAGE OF WOMEN ENROLLED IN UNDERGRADUATE ENGINEERING PROGRAMS (RYERSON VS. CANADA)

BACKGROUND

In 1989, Ryerson University established the Women in Engineering (WIE) Committee to develop strategies to increase the participation rate of young women in engineering at Ryerson. The WIE Office provides both outreach aimed at pre-university students (recruitment) and support for the women currently enrolled at Ryerson (retention).

Launched in 1991, the Discover Engineering Summer Camp is a summer day camp that targets female students in grades 10 to 12 [7]-[9]. Since its inception, more than 1200 young women have taken part in the programme. In 1999, the Discover Engineering High School Workshop programme was initiated to further raise awareness about engineering by bringing the hands-on activities directly to the classroom [5,6,10]. In 2000 the programme was expanded once again, to include the Discover Engineering Career Conference, an annual one-day event held on campus incorporating guest speakers, panel discussions, and hands-on activities. In 2001 the WIE Committee launched the

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Discover Engineering 'be prepared' programme in conjunction with Girl Guides Canada (Toronto Chapter), where girls aged 9-12 have the opportunity to learn about engineering and earn their Engineer Badge.

For female students enrolled in engineering at Ryerson, a number of support programmes are in place. An on-line mentoring programme, Mentor-Link, was launched in 2000 to assist the students in their career planning process, and based on the success of Mentor-Link, the WIE Office plans to launch an on-line peer-mentoring program next fall. At the beginning of each academic year, all first-year women engineering students are invited to attend an evening of social activities to welcome them into their programme of study. Ryerson also has a full time WIE Co-ordinator who hosts regular drop-in hours in order to field any questions or concerns from women engineering students.

This paper describes the activities that have been effective in recruiting women into engineering programmes and supporting the women engineering students at Ryerson.

RECRUITMENT ACTIVITIES DISCOVER ENGINEERING

The main objective of Discover Engineering is to provide education to students, especially young women, about engineering and to show them that it can be a viable career choice. This objective is achieved through involvement in hands-on activities, exposure to undergraduate engineering students, instruction by women science and engineering faculty and staff, and panel discussions with women professional engineers.

The main outcome is to increase awareness about the many facets of engineering and hopefully to convince some of the students to pursue engineering as a career.

Discover Engineering Summer Camp

The primary objective of the summer camp programme is to introduce young women in high school to the challenges and rewards of engineering through a variety of fun, hands-on activities and discussions led by women engineers, scientists and students. Although the students have usually already chosen to continue with the math/science stream in high school, they have not necessarily decided on a career path. The overall goal of the programme is to increase awareness among these students about careers in non-traditional areas of applied science, at a time when a decision about post-secondary education is at the forefront of their minds.

The summer camp is a week-long day camp based on hands-on activities in a stimulating learning environment, which allow the young women to achieve success by working on comprehensive engineering projects in a variety of engineering fields. Camp counsellors, who are women undergraduate engineering students, guide the participants throughout the week as they attend various sessions taught by women faculty, staff and alumni.

Discover Engineering High School Workshops

The high school workshop programme was initiated in September 1999 as an extension to the summer camp. The goal of the new initiative is to raise awareness about careers in engineering among all high school students. This means that the programme is offered in a co-ed classroom environment and not just to female students. However, the use of female presenters (faculty, staff and engineering students) provides strong positive role models for the young women. As well, this helps change stereotypical perceptions of engineers, held by both male and female students in the audience.

Each workshop begins with a 15-20 minute discussion about what engineering is, how it applies to our daily lives, and about opportunities in engineering. After the discussion, a hands-on activity takes place followed by a question & answer and workshop evaluation period. Duration of workshops are tailored to the school's schedule, and typically run for 70 minutes.

Discover Engineering Career Conference

Since 2000, the WIE Committee has hosted an annual career conference for young women in high school. This initiative is designed for female high school students, their parents, teachers and guidance counsellors to explore careers in engineering. During the day, the participants take a close look at careers in engineering and meet with successful women from the profession. The programme begins with a panel discussion session where women working in various engineering-related careers share some of their stories. This is then followed by a number of workshops from which the participants choose two workshops of their choice.

Discover Engineering Girl Guide Workshops

In 2001, the WIE Committee launched the Discover Engineering 'be prepared' programme in conjunction with Girl Guides Canada (Toronto Chapter). This unique opportunity benefits both the young girls involved in Girl Guides and the women engineering students at Ryerson. The project is designed with two main goals. The first is to raise awareness among young girls who have not yet considered engineering as a potential career path, due to a lack of knowledge, interest or confidence, by presenting engineering in a fun and friendly manner. The second goal is to provide Ryerson's engineering students the opportunity to interact with young girls as role models and mentors.

Each Girl Guide involved in the program has the opportunity to earn her Engineer Badge as part of the programme. The workshops provide information about the fields of engineering so that the Guides can name various types of engineers, some of the devices that have been engineered, and how these have made life better.

For the women engineering students that are involved in the teaching and implementation of the project, it is an excellent opportunity to share their engineering experiences

and to be looked up to as role models and mentors. This opportunity enhances the education that they receive in the classroom and builds their confidence and dedication for the profession.

IMPACT OF RECRUITMENT ACTIVITIES

Through the use of questionnaires and evaluations, we have been able to survey the students about their knowledge of engineering before and after participating, and assess the impact of our programmes on their interest in pursuing engineering as a career option.

Almost all of the summer camp (DESC) and career conference (DECC) participants indicated that the camp increased their knowledge about engineering as well as their interest in considering engineering as a career option. When brought directly to the classroom, over three-quarters of the workshop (DEHS) participants indicated that the programme increased their knowledge about engineering and almost half indicated that the programme influenced them to investigate engineering as a career option (Figure 2).

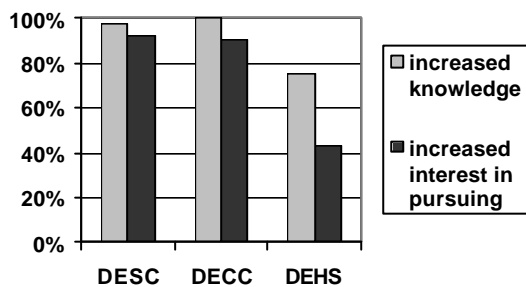


FIGURE 2

IMPACT OF DISCOVER ENGINEERING PROGRAMMES ON KNOWLEDGE OF ENGINEERING AND INTEREST IN PURSUING ENGINEERING AS A CAREER

Discover Engineering Summer Camp 2001

- 120 high school students (female) representing 61 high schools across the Greater Toronto Area (GTA).
- **98%** of the young women who came to the 2001 summer camp indicated that the camp increased their knowledge about engineering.
- **92%** of the young women who came to the 2001 summer camp indicated that the camp increased their interest in considering engineering as a possible career.
- Choice of Engineering as a 'career direction' **increased from 16.5% to 47.5%** after attending the 2001 summer camp.
- "Awesome program! I think this is a great way to encourage young girls to consider engineering as a career opportunity".
- "A great camp that has completely changed my opinion on engineering, and possibly my future".
- "I had a lot of fun, please continue making other girls aware of (these) career possibilities".

Discover Engineering High School Workshops 2000/2001

- 1190 high school students (male and female) representing 15 high schools across the GTA.
- **79%** of the young women who participated in the 2000/2001 high school workshops indicated that the workshops increased their knowledge about engineering.
- **71%** of the young men who participated in the 2000/2001 high school workshops indicated that the workshops increased their knowledge about engineering.
- **37%** of the young women who participated in the 2000/2001 high school workshops indicated that the workshops increased their interest in considering engineering as a possible career.
- **50%** of the young men who participated in the 2000/2001 high school workshops indicated that the workshops increased their interest in considering engineering as a possible career.
- "I love the workshop. It is very interesting. It gave me a very good introduction to engineering".
- "Great workshop. I never knew engineering had such a wide field. I never considered the possibility of engineering until now".
- "This was a highly interesting workshop that has influenced me to think about engineering".

Discover Engineering Career Conference 2001

- 89 high school students (female) representing 37 high schools across the GTA.
- **100%** of the young women who came to the 2001 career conference indicated that they found the conference informative.
- **91%** of the young women who came to the 2001 career conference indicated that the conference increased their interest in considering engineering as a possible career.
- "I am deciding to go into engineering after what I learned in this conference".
- "(It) really helped me learn about engineering".
- "It definitely gave me a lot of information. I am now considering a career in aerospace or genetic engineering".

Long-term success of Discover Engineering

Exit surveys have been conducted among camp participants since 1991. To measure a long-term success of the camp experience and to track the number of participants who go on to choose engineering as their field of study, follow-up phone surveys were conducted in 1993, 1996 and 1999. On average, 80% of the interviewed camp alumni went on to study at a university. There, over half enrolled in engineering programmes, and of those, almost three-quarters said that the summer camp experience greatly or moderately influenced their decision [5] (Figure 3).

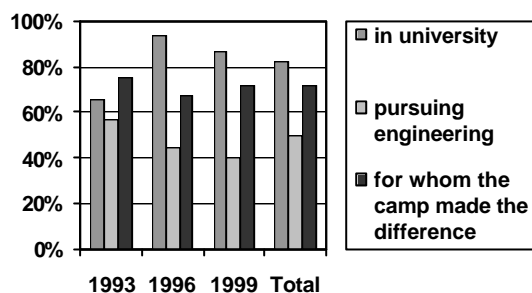


FIGURE 3
LONG-TERM SUCCESS OF DISCOVER ENGINEERING

RETENTION ACTIVITIES RYERSON'S WOMEN IN ENGINEERING OFFICE

It is not enough to simply recruit under represented groups into engineering programmes, retention of these groups is vital. An 'open door' that acts like a 'revolving' one will not improve the issues of under representation [11].

In Canada, the retention rate for male students remained at approximately 55% during the 1990's. For women, the percentage was much higher and ranged from 60% to almost 75% in the same time period [3].

WIE Co-ordinator

Although Ryerson has had a WIE Committee since 1989, and part-time WIE Co-ordinators since the launch of the summer camp, in 1999 a full-time WIE Co-ordinator was hired.

The Co-ordinator of the WIE Office hosts regular drop-in hours in order to field any questions or concerns from Ryerson's women engineering students. The Co-ordinator provides counselling and referrals (personal, career, academic), when appropriate, to students in need. Having a consistent, identifiable service available to students is essential in ensuring a supportive learning climate for women in engineering.

On-line mentoring programme: Mentor-Link

In 1999, the WIE Office launched an e-mail based mentoring programme for women engineering students, to enhance their career planning process and transition to the world of work.

Undergraduate engineering students are invited to apply to Mentor-Link, and those selected are matched with a woman engineer working in their field of interest. Mentors are invited to participate based on their previous participation in Women in Engineering projects at Ryerson, such as speaking at the Discover Engineering summer camp or career conference. Mentors receive an information package with guidelines on mentoring undergraduate students and both students and mentors receive e-mails from the WIE Co-ordinator, to offer discussion ideas and gauge

any progress. Mentors are encouraged to share their experiences with one another over e-mail, and students are encouraged to the same.

Though the programme is structured around dialogue only, mentors have the option of arranging a work-site visit for their student, often referred to as a 'job shadow day'. When launched in the 1999/2000 academic year the programme ran for four months, but has since been expanded to a full year. The programme is facilitated by the WIE Co-ordinator, after which the mentor and student may choose to maintain their mentorship independently and at the discretion of the mentor.

The programme is evaluated each April, with questionnaires for both students and mentors in order to obtain their feedback and recommendations.

On-line peer-mentoring: Student-Link

Due to the success of the Mentor-Link programme, next fall the WIE Office plans to launch an e-mail based peer-mentoring programme for women engineering students to enhance their career planning process.

Undergraduate engineering students will be invited to apply to Student-Link in the Fall 2002 term, and junior engineering students (1st and 2nd year) will be matched with senior engineering students (3rd and 4th year) in the same Department.

Annual Women in Engineering welcoming event

At the beginning of each academic year, all women engineering students are invited to attend an evening of social activities to welcome them into their new academic year. Each student is sent an invitation in the mail, and student volunteers remind students about the event over the phone. In addition to in-coming students, senior women engineering students are invited to attend so that they may share their undergraduate experiences in their respective programmes and network with in-coming students. Women engineers attend the event as guest speakers. The Dean of Engineering, Departmental Chairs and various Faculty members are also invited. This project is particularly valuable given that it introduces students to a support network at an early stage in their academic career.

Volunteer opportunities and skill building opportunities

Several volunteer opportunities exist for women engineering students to get involved with the WIE Office. The Discover Engineering initiatives combine volunteer work with specific skill building opportunities. The Discover Engineering high school workshop and Girl Guide workshop programmes offers students an opportunity to become trained workshop presenters in order to gain teaching experience, as well as enhance their public speaking and communication skills. Students feel empowered as they learn the value of being a positive role model for younger students.

IMPACT OF RETENTION ACTIVITIES

Mentor-Link 2000 - 2002

The Mentor-Link programme is very popular with both the Ryerson engineering students and the mentors participating. It has also proven to be 'low-maintenance' given the convenience and flexibility that e-mail offers, delivering several benefits to both students and mentors. Students are encouraged and inspired by successful women engineers, and mentors are often overwhelmed at how important the mentorship makes them feel, as well as how they can make a meaningful difference in a young person's life by sharing their career-related experiences and building confidence within the student.

All of the students participating in the Mentor-Link programme have indicated that they would recommend the programme to a friend.

Table 1 outlines the topics discussed by the programme participants, and notes the percentage of Mentor-Link students who indicated that they discussed the topic.

TABLE I
MENTOR-LINK TOPICS DISCUSSED

Topics	Discussed
Personal backgrounds (education, interests, etc.)	94%
Student's future career plans	94%
Mentor's job, prior work experiences	88%
Job hunting, interviewing	82%
Managing time, stress, or workplace demands	65%
Industry workplace, culture, values	65%
Balancing a career and other interests, family, etc.	59%
Coursework, majors, or advanced degrees	59%
Differences between academia and industry	59%
"Social stuff": jokes, stories, personal news	53%
Student's reasons for participating in Mentor-Link	53%
Mentor's future career plans	53%

Quotes from Mentor-Link participants (students):

- "I have more confidence in my future career than I used to."
- "(My mentor) helped me a lot with my decision regarding graduate studies."
- "The programme is fantastic. It has allowed me to meet a female engineer in the industry and it has allowed me to gain knowledge about my future in university and in the workforce."

CONCLUSIONS

Recruitment activities are essential tools for increasing awareness about the engineering profession at the pre-university level. Our studies have shown that participation in outreach programmes such as Discover Engineering significantly increases interest in pursuing engineering as a career.

Retention activities, in the form of support programmes, are critical for retaining under represented groups, achieving

diversity in engineering schools and strengthening the profession.

While it is difficult to track the actual increases in engineering enrolment due to the Discover Engineering programme and the WIE Office, the recruitment and retention rates for Ryerson indicate a positive contribution that the Women in Engineering Committee is making toward its stated goal of recruiting women into engineering and supporting the women enrolled in our programmes. In fact, the two undergraduate engineering students currently working as Program Officers for the 2002 Discover Engineering programmes each participated in Discover Engineering prior to attending Ryerson. Many other summer camp alumni have assisted the WIE Office while studying at Ryerson, and even returned after graduation to participate as Mentor-Link mentors.

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