

GO WEST: PROMOTING ENGINEERING AWARENESS - STARTING A HIGH SCHOOL OUTREACH PROGRAM

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ABSTRACT

GO WEST is a new program at the University of Victoria designed to immerse high school students in all aspects of engineering. The program was started by engineering students in response to a need felt at the university to increase female enrollment in engineering. In August of 1998, a week-long female engineering youth conference was run by engineering students, with 30 female high school students taking part. The conference was based on Ryerson Polytechnic's successful Discover Engineering program.

The response from the participants was so positive that the full GO WEST program was founded during the summer of 1999, running from May to August. This included two months of high school classroom visitations by GO WEST staff and six youth conferences, two of which were female-only.

GO WEST endeavours to increase female enrollment in engineering by sharing knowledge about what engineering is about, delivering hands-on engineering experience, and providing female engineering mentors. In starting up GO WEST, the organisers had to tackle challenges, including funding, planning, promotion, and project creation. By learning about and taking on these challenges, more programs like GO WEST can be started and can make a difference in the lives of young women.

Even people who are not starting up their own outreach program can get involved with initiatives such as these. Students, professors, engineering professionals, or engineering graduates can go a long way to help develop both outreach programs and the career prospects of many young women.

THE GO WEST OUTREACH PROGRAM

Background

The University of Victoria boasts a relatively new Faculty of Engineering, established in 1983 with a Department of Electrical and Computer Engineering, and expanded in 1987 to include a Department of Mechanical Engineering. The faculty offers B.Eng degrees in Computer, Electrical and Mechanical Engineering.

The following graph shows the female enrollment by class year in engineering at the University of Victoria (UVic). Due to a low sample size, the graph demonstrates the total numbers instead of the percentages for a better perspective.

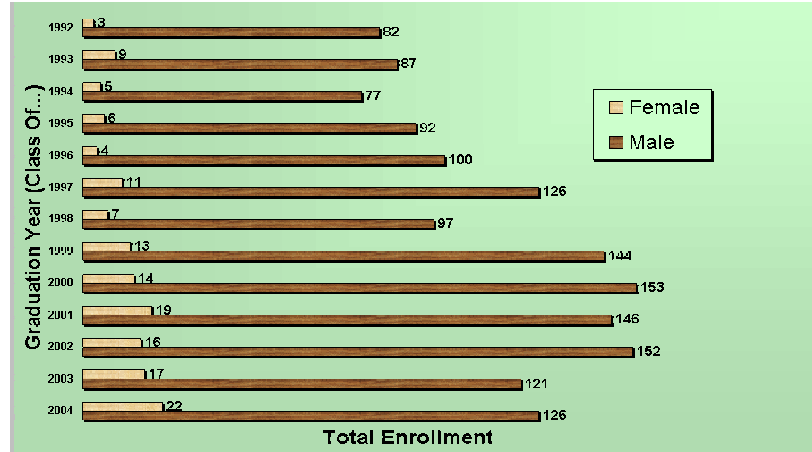


FIG. 1.1: TOTAL ENROLLMENT BY GENDER AND CLASS AT UVIC

In 1995, women made up 19% of the student body in Canadian engineering programs, ref [2]. The percentage of female students is low at the University of Victoria compared to the rest of Canada due to the disciplines offered. The disciplines of mechanical, electrical and computer engineering have some of the lowest female enrollment rates. The following graph illustrates female enrollment by degree across Canada, ref [2], and at UVic.

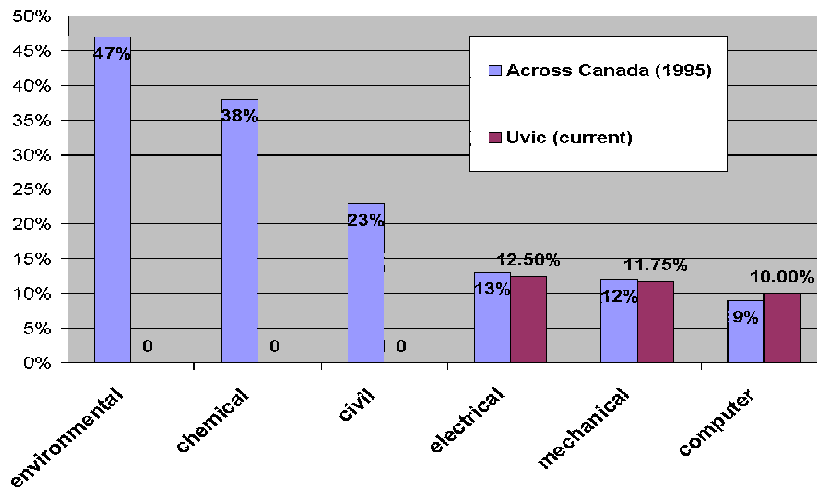


FIG. 1.2: PERCENTAGE FEMALE ENROLLMENT BY DISCIPLINE ACROSS CANADA AND AT UVIC

Something had to be done about these low percentages. Some of the engineering students at UVic had heard about the successful Discover Engineering program at Ryerson. The organisers there are able to indicate that approximately 60% of the young women who attended that camp went on to pursue engineering at university, ref [1]. Moreover, these young women also believed the camp was important in their decision.

The Program

GO WEST was started in August of 1998, when a week-long female engineering youth conference was modeled after the Discover Engineering Summer Camp and held at the University of Victoria. 30 female high school students from around Victoria participated in the week which included project building, laboratory tours, industry tours, a stay-over night in the university residences, and a panel discussion with female engineering students and professionals. Some of the costs for supplies, the residence stay-over, a barbecue on the last day and transportation to industry tours were handled by sponsoring engineering companies, and each participant paid \$75 to cover the rest.

The response from the participants was so positive that the program was expanded to four months in 1999. The full program included school presentations during May and June, and six youth conferences, two of which were female-only, during July and August. Co-ed conferences were included in the program due to demand from male high school students as well as a lack of population base to support a full female-only program. Three full time staff were hired for four months, two of whom were recent graduates and one of whom was on a co-op workterm. In addition, a local high school student was hired during July and August to look after the office.

School presentations occurred in many high schools in Victoria, and in over 50% of the high schools on the rest of Vancouver Island, including Nanaimo, Parksville, Qualicum, Campbell River, and Duncan. The presentations consisted of either a career talk or a workshop and were intended for students in grades 9 through 12. Career talks guided students through the career path of an engineer, including the skills, education and motivations involved. The presentation also included a question and answer time, an overview of engineering disciplines, personal talks by GO WEST presenters, and a glimpse into UVic's program. Workshops combined hands-on engineering fun with learning about the skills engineers need such as creativity, communications, and team-work skills. Students were provided with a set of supplies with which to solve an engineering problem within a certain time period. At the end of the allotted time, students presented and tested their solutions. Workshops also included an abridged career talk. University life, the co-op program, academic work and relaxation were covered in both presentations.

The week-long youth conferences kept the main format of the year before, but included new projects and dropped some of the laboratory tours and unpopular projects. During the summer at UVic, the faculty operates as normal due to its mandatory coop program, so constant laboratory tours would have strained its resources. The stay-over night at the university residences was removed as well, due to funding constraints. Two conferences, however, were designated as out-of-town weeks and offered some nightly supervision and activities to participants staying in the residences. The added cost for this was shouldered by the participants. The youth conferences cost participants \$140 for the week, while the residences were \$22 per night.

In 1999, GO WEST reached almost 1000 students through school tours and 130 participants through week-long conferences.

The Future

This year's team is hoping to reach up to 1500 participants during school tours and 125 during week-long conferences. The format of the program will remain basically unchanged this year as it will strive to grow and develop as a known and respected resource. Three female engineering students have been employed for the summer of 2000, and one of the GO WEST 1999 organisers is online to return and direct GO WEST 2001.

Comments from Participants

School Presentations. GO WEST asked for feedback from the teachers, and also received unsolicited feedback from some of the students.

"Student feedback (was) very positive. Especially the girls in the class - they appreciated female participations [sic]"- Physics Teacher, High School in Nanaimo

"I was shocked and excited that there were females, and I should have known. We made a motor, which is what we happen to be working on in Physics right now, and it was so cool! Hands on experience, with young smart females is very impressive and exhilarating. They make engineering fun and youthful and there are so many

options. I enjoyed winning candy and our pinnochio nose was really cool.” - Female Participant, High School in Nanaimo

“I thought that their presentation was very interesting and fun and kept me into everything they did. The lab was a lot of fun and since they too were girls I felt even more interested in the engineering program.” - Female Participant, High School in Nanaimo

Conferences. At the end of each week, participants filled out a feedback form. Some of the comments from female-only weeks were as follows.

“I was so proud of myself that I figured it out”

“Hearing the advice from the panelists really helped”

“I really loved programming the robot...it was really cool”

“...enjoyed the laid back sense of the program”.

STARTING THE PROGRAM

While starting the program did present some challenges to the GO WEST team, its feeling of achievement was very rewarding. Other people who would like to start their own program can learn from these challenges to initiate a new outreach team and project.

Funding

The success of the 1998 week-long program was used to establish viability of a program of this type in the Greater Victoria and Vancouver Island region. The feedback and positive results from the program became the basis of funding applications to government wage subsidy programs and corporate sponsors. The positive reaction of these groups to the 1998 program enabled the expansion of GO WEST to a four-month initiative.

Funding for GO WEST came from three main sources: government wage subsidies, corporate sponsors, and participant registration fees. Provincial and federal government wage subsidy programs provided between \$4 and \$7 an hour towards staff salaries. Corporate sponsors provided between \$5,000 and \$15,000 towards fixed costs including advertising, office equipment, program brochures, etc.... Registration fees covered the remaining staff salaries and fixed costs of the GO WEST program.

Typical registration fees for programs of this type are \$130 - \$150 per week per participant. The variable cost for project supplies, t-shirts, and other miscellaneous items on a per camper basis can be limited to one third of the registration cost. This allows a \$90-\$100 contribution margin to cover fixed program costs and staff salaries. This contribution margin, combined with a high number of participants is what makes a program such as GO WEST financially viable. Ultimately, increased corporate sponsorship will reduce the cost burden on program participants and make the program accessible to a greater audience.

Goal Setting and Planning

One of the most important elements was creating a common vision for all of the involved organisers and then using the vision to plan the program and create goals for the year.

The following statements summarized the GO WEST Vision

- provide engineering awareness
- aim specifically at groups who are not necessarily exposed to engineering through other facets of everyday life
- endeavour to increase female enrollment in engineering
- share knowledge, deliver hands-on engineering experience, and provide female engineering mentors to accomplish the above

Creating realistic goals was difficult since it was hard to gauge what would be possible, but they provided the team with something to work towards. The goals were changed along the way as the work progressed.

Planning involved the creation of a timeline, brainstorming on how the elements in the timeline would be executed, creating a schedule, and budgeting. An organised and professional looking program creates a sound foundation. The in-school presentations were formed in such a way as to fit within the time limits, but move quickly and show as much as possible about engineering. The week-long conferences were scheduled to allow plenty of time for breaks, problems, and participants to get inspired with what they are doing. Ordering supplies and booking space should have been done well ahead of time, but some last minute scrambles still occurred. The program's office was well organised with a database of participants, schedules and personalized forms, and systems were set in place to deal with any requests for communications or registrations that came in.

Promotion

Even the best conceived program can not be successful without participants, and so promotion was extremely important.

Setting Up School Presentations. School presentations sometimes sell themselves with minimal work. The hard part in scheduling the school presentations came from the availability of time in the classroom and the availability of time on a school contact's part to organise them. A technique that worked well to set up a presentation was to fax a descriptive flyer to a career counsellor and/or science teacher. After waiting a day, a GO WEST organiser phoned a teachers and tried to arrange a presentation.

Filling Up The Week-long Conferences. The week-long conferences were harder to fill up, especially with female students. The market when promoting the week-long summer conferences was teenagers but even more importantly, their parents. Parents will often persuade their daughters to go to GO WEST to show them the career option as well as get them into something educational for a few days. Even so, the daughters needed to believe that participating in GO WEST would not make them look "nerdy" or "dorky".

Before any conferences were held, the GO WEST team found themselves facing the engineering gender barrier. Male participants outnumbered the female participants around 10 to 1. From that point forward, all publicity focused on female involvement, and a "engineering is not what you think!" campaign. The results were encouraging, but the focal shift may have been too late.

Sometimes the best way to break through the barrier was to sidestep it. To do this, aspects that young women find interesting were emphasized. Most of them would like to attend university, so learning about the university and university life was highlighted. In British Columbia, high school students need Career and Personal Planning (CAPP) work experience hours. Most schools considered participation in GO WEST as being worth 40 of these hours. Incentives such as this may have helped bring in participants who might not have enrolled otherwise.

The program budget permitted some advertising on radio and in print. Radio stations offered a 2 for 1 deal for non-profit organisations, but GO WEST found that even at these rates the interest generated was not ideal and led to less than 5 registrations. The best paid advertising for GO WEST was in the Times Colonist newspaper during a special summer issue. This still only generated a few registrations, however.

Free advertising was more affordable of course, and was often more effective than other methods. The best free advertising came from the local schools. During the in-school presentations, students had a chance to see that GO WEST was run by energetic and youthful leaders. Since presentations had a co-ed audience, subtle methods were employed to get the girls as interested as the boys. These included having female presenters, showing pictures of the female-only programs, and educating the presenters on classroom gender issues. School counsellors also helped advertise for GO WEST as they identified potential candidates and urged them to attend. Ads were inserted in school newsletters that went with the report cards and personal letters of invitation were sent to female honours students when possible.

Another form of free advertising was with the local media. GO WEST was interviewed on a few local radio and television stations, including CBC Radio Victoria. To get these interviews, press releases about the program were sent out and follow-up phone calls made to the media outlets. The university’s public relations representative was supportive and set up some of the interviews.

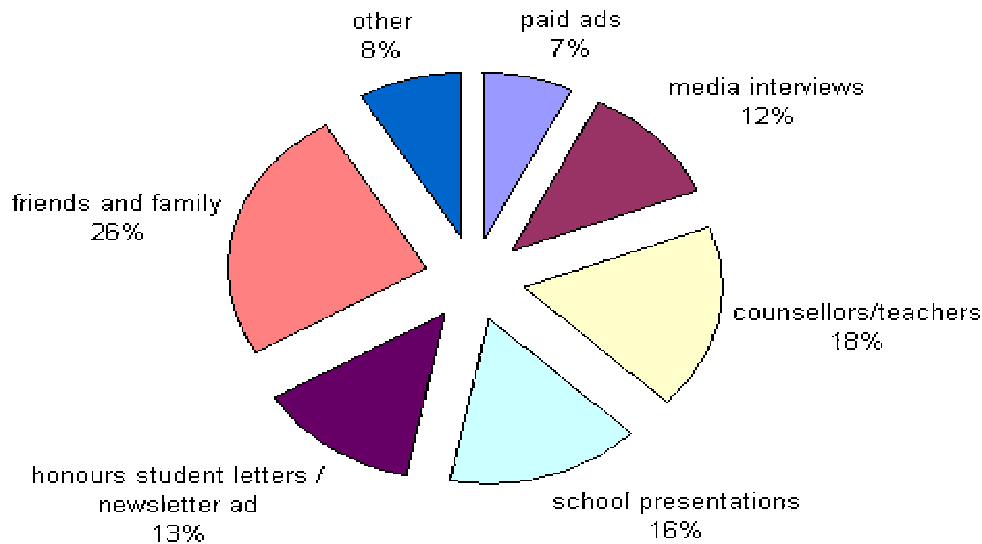


FIG. 1.3: WHERE PARTICIPANTS HEARD ABOUT GO WEST

Project Creation

Interesting projects during a program can enthuse and excite participants. However, tedious projects or projects that are too difficult can discourage a participant from the career option. Project creators thought about how to appeal to women, characterize engineering, and perform low-budget miracles.

Appealing to women. Activities in classrooms are unfortunately chosen to appeal more often to the boys rather than girls, ref [3]. Girls prefer to stay away from the competitive environments that are often encouraged in school, and excel when they work in small classes with cooperative learning, girls-only, and/or multi-age learning environments, ref [4]. Those that choose to go into engineering often do so in order to “make a difference” in the world or help others. These points were all in the forefront when devising projects.

Characterizing Engineering . Not surprisingly, doing the most interesting parts of engineering often requires the background education of an engineer. It is often easiest to characterize engineering with projects such as bridge building and structure testing. However, using only civil engineering as an example can reinforce traditional ideas about engineering, instead of stimulating the students with a new concept of engineering. Perhaps the hardest part of characterizing engineering in the non-traditional disciplines was coming up with projects that allow creativity. “How-to” projects can be used if at least a small part can be focused on design. For instance, one of the GO WEST projects was to build an electronic piano. Although participants had to follow the design quite carefully, they were able to choose the tones that would play by experimenting with certain component values and using those they liked.

Low Budget Miracles. During a high school Foods and Nutrition course, students are challenged to come up with a dinner that costs only \$1 per person for four people. Some students bring in Kraft Dinner or baked beans, but others put their heads and hearts into it and create a souffle or a quiche. Often, we don’t realize that excellent results can be achieved with low budgets. In fact, many supplies are inexpensive, and just need to be put together in the right way to make an amazing project. For instance, many electronic parts are under a dollar each: Light Emitting Diodes (LEDs) and transistors can each cost less than 20 cents. Projects that involve working on computers and learning to program are free if the computer resources are available.

A description of the projects put on at the GO WEST week-long conferences is in the appendix.

GETTING PERSONALLY INVOLVED

Even those who are not at a university or working with an outreach program can get involved and help out. One of the best ways is to help out for a few hours with a local program. At GO WEST, panelists for the panel discussions were always in demand, as well as mentors during the day. Panel discussions are usually just as interesting for the panelists as for students, as they learn about the high school students thoughts and ideas, and even what the engineering profession has brought to other panelists.

Those working at engineering companies can encourage their company to help out both with sponsorship and time. Funding for outreach programs is tight, especially to begin with, and any donations or sponsorships received helps reduce registration fees. A company's time can be given in the form of interesting tours of the company, or in employees coming to visit the outreach program and their participants. Visits such as these raise the visibility of the career option, and can be worthwhile to companies who will depend on these future engineers.

Undergraduate and graduate students can also lend some support by volunteering their time. Usually, laboratory tours are much more interesting when given by a younger, energetic student instead of the perhaps quieter and older professor. Students can also drop in for a few hours for the panel discussions or projects to lend a hand and show their faces.

REFERENCES

[1] Discover Engineering Summer Camp For High School Girls At Ryerson Polytechnic University - A Recruitment Strategy That Works, Peter D. Hiscocks and Malgorzata S. Zywno, Ryerson Polytechnic University, Toronto, Ontario, May 1998

[2] CCWEST, "Statistics Regarding Women's participation in Engineering at University level", www.cctest.org/english/numbers/stats.html, 1997

[3] Secada, Walter G, et al. New Directions For Equity in Mathematics Education, Cambridge University Press, 1995

[4] AAUW Educational Foundation, "Growing Smart:What's Working for Girls in Schools", AAUW Educational Foundation Research, 1995

APPENDIX - PROJECT LIST

Design Challenge

Based on the Team Design Competition from the Canadian Engineering Competition. Participants are given an engineering problem, a time limit, and supplies with which to solve the problem. Teams of 4-6 design, construct, and present their solution.

Prosthetic Arms

participants partner up and are given a scenario to solve by creating a prosthetic arm. An example scenario is one in which a person has lost their arm through too much smoking, but would like to be able to feed their baby. Each partnership has their own scenario and must demonstrate how their solution works by using their new “arms” to perform the required action. Arms are made up of PVC tubing, with plastic sticks that may be used as fingers, rubber gloves as coverings, and nuts and bolts to bring it all together.

Virtual Town

An OpenGL program was created to enable participants to write simple code that would create 3-D objects on a virtual plot of land. Each person’s plot of land was brought together to make up a street and participants could navigate through the street and look at each others houses.

HTML workshop.

Participants learned HTML and put up their own webpages. Some participants were using the Internet for the first time, while others were more advanced and already had experience making webpages.

Laser Communications

The earphone jack on a radio was connected to a laser which shone to the other side of a table and onto a solar cell. The cell was connected to the microphone input of a stereo. In this configuration, participants could “beam” music signals across the room.

Electronic Piano

Using a 555 timer, some capacitors and resistors, and a speaker were used to create a little “piano” that would play seven tones (from the YES-VACC project book).

Remote-Controlled Cars

Cardboard, glue, paper clips, wire, motors and batteries made up these cars. Participants controlled them through a wire cable attached to the “control pad” they held in their hand.

LEGO Dacta

Programming LEGO...what could be better. The LEGO is programmed to move to certain positions and angles with a motor, as well as blink a light, etc. Usually the highlight of the week for many participants.