

Discover Engineering Follow-up Surveys: Assessment/evaluation of recruitment programs

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Abstract—In 1991, Ryerson University's Women in Engineering (WIE) Committee launched the Discover Engineering Summer Camp to encourage young women to consider engineering as a future career. In recent years, Discover Engineering has expanded to include a one-day career conference, in-class high school workshops, and a conference for girls aged 9-12. Through the use of questionnaires and evaluations, the WIE Committee has been able to assess the impact of our programs on the participants' interest in pursuing engineering as a career. To measure the long-term success of Discover Engineering, and to track the number of young women who eventually go on to study engineering, follow-up phone surveys have been conducted regularly with past camp participants. Assessment of recruitment programs is essential, and this paper will outline the methods used, and results of the Discover Engineering Follow-up Surveys.

Background

Discover Engineering was launched as a summer camp and has expanded to include a broad range of activities. Discover Engineering now includes the Discover Engineering Summer Camp, Discover Engineering Career Conference, Discover Engineering High School Workshop program and Discover Engineering Girl Guides Conference (Anderson & Gilbride, 2003; Anderson & Gilbride, 2002; Gilbride, Kennedy, Waalen & Zywno, 1999; Zywno, Gilbride & Gudz, 2000; Zywno, Gilbride, Hiscocks, Waalen & Kennedy, 1999).

The Discover Engineering Summer Camp was established in 1991 by the WIE Committee and its industry partners. The primary objective of the program was 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. Female students who have completed grade 10 comprise the target audience; however, girls who have completed grades 9-12 are also welcome. 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. Unlike some other science and engineering programs for youth, the Discover Engineering Summer Camp is delivered exclusively to women. The overall goal of the program is to increase awareness among these students about careers in non-traditional areas, at a time when decisions about post-secondary education are at the forefront of their minds.

The Discover Engineering High School Workshop program was initiated in September 1999 as an extension to the summer camp. The goal of the new initiative was to raise awareness about careers in engineering among all high school students. This means that the program 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. The Discover Engineering workshop program is staffed by Ryerson University faculty, staff and students. Like the summer camp, the purpose of the workshop program is to encourage young people, especially women, to pursue a career in engineering. Each workshop begins with a short discussion about what engineering is, how it applies to our daily lives, and about career 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.

In May 2004, the WIE Committee celebrated the 5th Anniversary of the Discover Engineering Career Conference program. This initiative was designed for female high school students, their parents, teachers and guidance counsellors to explore careers in engineering. This one-day event is designed for young women currently in/entering grades 11 and 12. During the day, the participants take a close look at careers in engineering and meet with successful women from the profession. The program begins with a Panel Discussion session where women working in various engineering-related careers share some of their stories. This is followed by hands-on workshops and campus tours.

Since 2002, Girl Guides Canada (Toronto Chapter) and Ryerson University have partnered to present a one-day Discover Engineering Girl Guides Conference to local area Girl Guides, ages 9-12. 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 by presenting engineering in a fun and friendly manner. The second goal is to provide female engineering students the opportunity to interact with young girls as role models and mentors. The Girl Guides Conference includes a short discussion about what engineering is and how it applies to our daily lives. This is followed by four different hands-on activities, representing four different engineering disciplines. The Guides participate in each of the four sessions over the course of the day, and each Guide involved has the opportunity to achieve and receive her Engineer badge at the close of the day.

Program Assessment

Assessment of program goals is essential in order to obtain and maintain funding, whether from internal or external sources (Bottomley & Parry, 2002). Popular assessment methods for outreach programs include the use of pre- and post- questionnaires on the students' educational background, engineering knowledge, and their engineering career interests (Inman, Anderson-Rowland, Castro & Zerby, 2003) as well as surveys of past participants (Sexton, Watford & Wade, 2003).

Exit Surveys

Through the use of pre-program questionnaires and post-program evaluations, Ryerson's WIE Committee has been able to survey students about their knowledge of engineering before and after participating in each of our Discover Engineering programs, and assess the impact of our programs on their interest in pursuing engineering as a career.

Exit surveys have been conducted among camp participants since 1991 and, consistently, we have found that almost all of the participants indicate that the camp increased their knowledge about engineering, and over 80% indicate that the camp increased their interest in considering engineering as a career.

The results of the exit surveys for recent Discover Engineering programs are reported in Table I.

Table I
Discover Engineering Exit Surveys

Program	2001	2002	2003	2004
Discover Engineering Summer Camp (DESC)				
Number of participants (female students only)	120	100	85	50
Participants who indicated that the camp increased their knowledge about engineering	98%	99%	98%	100%
Participants who indicated that the camp increased their interest in considering engineering as a possible career path	92%	88%	83%	83%
Discover Engineering Career Conference (DECC)				
Number of participants (female students only)	89	100	88	89
Participants who indicated that the conference increased their knowledge about engineering	100%	96%	100%	98%
Participants who indicated that the conference increased their interest in considering engineering as a possible career path	91%	86%	79%	67%
Discover Engineering High School Workshops (DEHS)				
Number of participants (male and female students)	1190	1900	1600	1500
Male students who indicated that the workshop increased their knowledge about engineering	71%	62%	60%	63%
Male students who indicated that the workshop increased their interest in considering engineering as a possible career path	50%	48%	48%	47%
Female students who indicated that the workshop increased their knowledge about engineering	79%	75%	69%	65%
Female students who indicated that the workshop increased their interest in considering engineering as a possible career path	37%	34%	36%	30%
Discover Engineering Girl Guides Conference (DEGG)				
Number of participants (girls only)			100	100
Participants who indicated that they enjoyed the conference			100%	100%
Participants who indicated that they might become an engineer			N/A	52%
Total Participants	1399	2100	1873	1739

Participant comments are collected at the end of each of our Discover Engineering programs and while they are anecdotal only, they do provide valuable information about the program's impact. While some comments address an increased awareness of engineering careers,

- *"It was very informative. Now, I know exactly what engineers do. Before, I had no or very little clue as to what engineering is about. Excellent job!" - DESC 2003*
- *"I had a wonderful week and this is a very influential camp. I am now more educated on engineering and am actually considering perhaps going into electrical engineering." - DESC 2002*
- *"I thought the workshop was very informative and it certainly broadened my knowledge about engineering and the different careers – thanks!" - DEHS 2002/2003*

others stress the combination of fun and learning.

- *"This was the most fun I have ever had learning stuff. Thanks for a great week!" - DESC 2003*
- *"This camp has been an amazingly fun, informative, and memorable experience and has given me a broader knowledge of what engineering is." - DESC 2003*
- *"I thought the workshop was really good. It was a perfect balance between being informative and being fun and hands-on." – DEHS 2003/2004*

Some students comment on the impact of hands-on activities and teamwork experiences,

- *"It was very interesting when we were doing the workshop because we were building something that would actually work." - DECC 2003*
- *"Awesome program! I think this is a great way to encourage us to consider engineering as a career. Very helpful, especially great to be able to apply the knowledge with fun and cool labs." - DESC 2001*
- *"I felt this was a great approach to apply engineering skills; it encouraged and challenged people's logical thinking. Most of all, People had fun!!!" – DEHS 2003/2004*

while others indicate an enjoyment of the overall program.

- *"Thank you very much for giving me this amazing experience. It was organized and a week full of non-stop fun." - DESC 2003*
- *"This camp is great. Thank-you so much for the awesome experience." - DESC 2002*
- *"I want to thank Ryerson for setting up a program like this to enlighten students more about engineering. Thanks." - DEHS 2002/2003*

In addition, there are often comments regarding a student's realization that engineering is a career that they should pursue.

- *"I have finally found the right job for me – engineering! Thanks a lot!" - DECC 2002*
- *"I am deciding to go into engineering after what I learned in this conference." - DECC 2001*
- *"I will consider engineering to be my future career." - DEHS 2001/2002*

Follow-up Surveys

Immediate surveys can assess whether a program was well received but cannot give long-term data (Bottomley & Parry, 2002). Therefore, follow-up surveys are conducted periodically, by telephone, with Discover Engineering summer camp participants from previous years, to track

the number of girls who eventually go on to choose engineering as their field of study and to find out the extent to which the camp influenced their career choices.

Discover Engineering follow-up phone surveys have been conducted regularly (in 1993, 1996, 1999, and 2003) with past camp participants (Zywno, Gilbride & Gudz, 2000). On average, over 40% of camp alumnae have gone on to study in engineering/technology programs, and of those, over 80% said that the summer camp experience greatly or moderately influenced their decision.

The Follow-up surveys can be categorized as normal distribution experiments, which have symmetrical distribution of the results, with scores more concentrated in the middle than in the tails. Consequently, a relatively small and statistically reliable sample size can be found that represents the whole population. For the most recent follow-up survey, campers from 1998-2000 were contacted. These cohort years were selected as it allowed almost all of the students to have completed high school. Based on the average number of girls who attended the camp from 1998-2000 (120 participants per camp), a statistically reliable sample number was calculated to be 90 (30 girls for each year). This sample size provides a $\pm 5\%$ error for a 95% confidence level. In other words, if the entire population of the girls were to be surveyed, 95% of the obtained results would agree with the results obtained from the sample size. To reinforce the reliability of the results, a much higher number of girls was surveyed. One hundred and eighty nine girls out of a total of 335 who attended the camp in 1998, 1999, and 2000, were surveyed, with 70/120 from 1998, 70/120 from 1999, and 49/95 from 2000.

Of the 189 girls surveyed, 86% (162 girls) were currently enrolled in or entering a post-secondary institution, 9% (16) had already graduated from a post-secondary institution, and the remaining were still in high school. Our Follow-up Survey did not track graduation rates of past participants, since the students were contacted only to three to five years after their camp experience over 90% were still in high school or a post-secondary institution.

Of the 162 students in/entering post-secondary institutions, 34% (55) were in engineering and 25% (4) out of the 16 graduated students had already obtained a degree in engineering. Overall, 31% (59) of the girls who attended the camp were pursuing engineering as a career.

The breakdown for fields of study chosen after attending the camp was as follows: 31% (59) chose Engineering, 27% (51) chose Pure Sciences, 10% (19) chose programs relating to Technology, while the remaining 32% (60) chose various other fields.

Out of the 59 girls who chose engineering after attending the camp, 41% (24) stated that the camp was the determining factor for their decision to study engineering. They also confirmed that before the camp they had limited knowledge about engineering due to a lack of exposure at home or at school, and that they construed engineering as a masculine field only. Through direct exposure to female engineering role models (undergraduate engineering students as camp counsellors and women engineers as panel speakers), the camp demonstrated to the girls that a career in engineering is very rewarding, and that they all have the potential to pursue it as a career. Forty six percent (27) of the total girls claimed that they were only moderately influenced by the camp to pursue engineering, since the camp only reinforced their interest in this field. The remaining 14% (8) of the girls stated that they had already decided to pursue

engineering and that the camp provided them with an opportunity to further explore this field. Overall, the camp was extremely well received by all of the participants, with over 85% (51) of the girls indicating that they were directly influenced by Discover Engineering. These results are similar to Follow-up Surveys conducted by other Engineering Summer Camps (Sexton, Watford & Wade, 2003).

Of the components of the camp presented to the girls throughout the week, the hands-on component was the best received of all, as selected by over 60% (132) of the campers.

The results of the most recent Follow-up Survey (2003) are reported in Table II, with results from the previous Follow-up Survey (1999) included for comparison.

Table II
Discover Engineering Follow-up Surveys

Survey	2003 Survey	1999 Survey¹
Camp cohort	1998-2000	1994-1997
Number of students surveyed	189	92
Area of study		
Engineering	31%	35%
Technology ²	10%	4%
Pure science	27%	25%
Other	32%	30%
Not Sure	N/A	5%
DE influence on students in Engineering		
Greatly influenced	41%	34%
Moderately influenced	46%	38%
No influence on decision	14%	28%
Most effective camp component		
Hands-on activities	63%	59%
Panel Discussion	15%	8%
Field Trips	5%	16%
All components equally effective	17%	17%

¹Zywno, Gilbride & Gudz, 2000

²Computer science, electronics/automotive/computer technologist (college), etc.

Conclusion

Through the use of questionnaires and evaluations the WIE Committee tracks the impact of Discover Engineering on participants' interest in pursuing engineering as a career. By utilizing follow-up surveys, as well as individual program evaluations, we are able to quantify the success of Discover Engineering in actual "number of engineering students" influenced by our program. These quantitative results are essential to our fundraising efforts, and have allowed Discover

Engineering to become, and continue to be, self-supporting through industry partnerships and grants and awards from government agencies.

Since its inception, more than 1300 young women have taken part in the summer camp program, and through follow-up surveys we know that over 500 young women have pursued engineering, with more than 400 of them directly influenced by Discover Engineering. In addition, even though summer camp participants may decide against pursuing engineering they still have gained knowledge of what engineering is and the opportunities that it offers, meeting our primary objective of introducing young women to the challenges and rewards of engineering and increasing awareness among these students about careers in non-traditional areas.

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