2010

"Engineer Your Life" Evaluation Report for Year 3

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Table of Contents

TABLE OF CONTENTS ..... **I**

ABOUT THE STUDY **1**

- Background 1
- Study Design 2
- Study Instruments 3

STUDY PARTICIPANTS **10**

STUDENT FINDINGS **12**

- Participant Characteristics 12
- School Experience 14
- Career Interests and Plans 18
- Engineering Knowledge and Attitudes 24
- Experience with Engineer Your Life 29

ENGINEER FINDINGS **33**

- Participant Characteristics 33
- Best Things About Life as an Engineer 33
- Choosing to Pursue an Engineering Career 35
- Engineer Role Models and Stereotypes 36
- Barriers to Women Entering Engineering 37
- Experience with Students/Career Counseling 38
- What Students Should Know about Engineering 41
- Experience with Engineer Your Life 48
- Website Only 52

CAREER COUNSELOR/EDUCATOR FINDINGS **55**

- Participant Characteristics 55
- Career Counseling 57
- Students & Engineering Opportunities 60
- Respondents' Engineering Attitudes and Knowledge 65
- Barriers to Women Entering the Field of Engineering 71
- Experience with Engineer Your Life 73
- Website Only 76

EYL PARTNER FINDINGS **78**

SUMMARY **83**

About the Study

Background

The Bureau of Labor Statistics has predicted that employment for engineers will increase by 11 percent between 2008 and 2018, with the most growth expected in the engineering, research and development, and consulting services industries.[1] Environmental engineers are expected to see the greatest growth—estimated at 31% growth during this projection period. Starting salaries for engineers are among the highest of all college graduates and a Bachelor's degree is typically required for most entry-level positions.[2] However, many students are graduating from high school with insufficient skills to pursue such entry-level jobs in this field.[3] Moreover, US colleges and universities are enrolling an increasing number of international students (a proportion of whom will eventually return to their home country with their education and skills) and a decrease in interest among American students in some key technical fields.[4]

The need to fill these gaps and encourage students in the US to consider science, technology, engineering, and math (STEM) careers is well-documented. Recently, The President's Council of Advisors on Science and Technology issued a report in which it argued, "As the world becomes increasingly technological, the value of these national assets will be determined in no small measure by the effectiveness of science, technology, engineering, and mathematics (STEM) education in the United States (page v)."[5] The Council further states, "Moreover, there is a large interest and achievement gap among some groups in STEM, and African Americans, Hispanics, Native Americans, and women are seriously underrepresented in many STEM fields. This limits their participation in many well-paid, high-growth professions and deprives the Nation of the full benefit of their talents and perspectives (page vi)."[6]

Males vastly outnumber females in undergraduate engineering programs. In 2007, men earned 81% of the Bachelor's degrees awarded in engineering and according to the National Science Board at the National Science Foundation, "…women's share of Bachelor's degrees in computer sciences, mathematics, and engineering has declined in recent years."[7]

Therefore, in an effort to prepare female high school students for a college curriculum and achieve gender parity in the engineering industry, WGBH has developed an initiative entitled, *Engineer Your Life* (EYL). The initiative is targeted toward female high school students, career

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[1] Bureau of Labor Statistics (2010). *Occupational Outlook Handbook, 2010-2011 Edition: Engineers.* Available online at http://www.bls.gov/opub/ted/2007/jun/wk4/art04.htm
[2] Ibid.
[3] Weill, S.I. (2008). High schools focus on engineering. *Industrial Engineer*, Vol. 40*(1)*, 16.
[4] Building Engineering and Science Talent (2010). *The Talent Imperative: Meeting America's challenge in science and engineering, ASAP.* Available online at http://www.bestworkforce.org/PDFdocs/BESTTalentImperativeFINAL.pdf
[5] Executive Office of the President (2010). *Report to the President: Prepare and Inspire, K-12 education in science, technology, engineering, and math (STEM) for American's future.* Available online at http://www.whitehouse.gov/sites/default/files/microsites/ostp/pcast-stemed-report.pdf
[6] Ibid.
[7] National Science Board, National Science Foundation (2010). *Science and Engineering Indicators: 2010.* Available online at http://www.nsf.gov/statistics/seind10/start.htm

counselors/educators, and professional engineers. It is designed to: 1) increase these target audiences' understanding of engineering, 2) inspire young women to explore engineering as a career option and 3) help adults encourage young women to investigate engineering opportunities.

Study Design

One component of this initiative involves collecting survey and other types of data to both track changes in attitudes and knowledge over time as well as to evaluate the impact of the EYL initiative. To achieve these goals, we have collected several types of data to inform WGBH's efforts. In Year 1 (2007 – 2008) American Institutes for Research (AIR) collected baseline survey data to inform the development of the EYL initiative and set the baseline to measure its effectiveness over time. In 2009, Veridian inSight collected Year 2 survey and interview data. In Year 3, Concord Evaluation Group (CEG) collected survey and interview data.[8]

Table 1 summarizes the type and frequency of data collection for the evaluation.

Table 1:

EYL Evaluation Data

Type of Data	Year 1 (2008)	Year 2 (2009)	Year 3 (2010)
Survey of career counselors and educators	X	X	X
Survey of engineers	X	X	X
Survey of college-bound, female high-school students	X	X	X
Interviews with EYL partners		X	X

The study was designed to capture data over a period of three years from the three main cohorts of interest: professional engineers, career counselors and educators, and college-bound females.[9] The study was not designed to be a longitudinal study of the same individuals over time. Rather, the surveys will capture data from unique members of each cohort over time.

These data provide a "snapshot" of attitudes, knowledge and beliefs among key audiences at three points in time: before the EYL initiative was launched, the year of its launch, and one year after EYL was launched.

[8] All three years of data collected were conducted under the direction of Dr. Paulsen, who left AIR in 2008 to start Veridian inSight. In 2010, Veridian inSight's name was changed to Concord Evaluation Group.

[9] Throughout this document we use the terms "college-bound, high school females", "academically-prepared girls" and "students" interchangeably. We make distinctions when necessary.

Study Limitations

The samples were not randomly selected from the populations of interest. Such a randomized study design was impractical for this project as no comprehensive list of academically-prepared students exists. Instead, we identified the populations of interest and reached out to as many members of these groups as possible, with the goal of reaching out to all members of a given cohort. Our recruitment strategies are described below. After making the initial contact with members of the target cohorts, individuals self-selected into the study. Because random sampling was not practical for this study and because the sample is self-selected, generalizing the findings to the populations represented is a challenge.

Another limitation of the study is that we have not tracked survey respondents by name, so we cannot know definitively whether some individuals responded to the surveys more than once, or more than one year in a row. This was a limitation we were prepared to accept when we designed the study; we chose to administer the surveys anonymously, in part, to protect the identity of minor students. We also chose this design to encourage candor and honesty among adults in the survey. To address this limitation, we have reviewed all IP addresses for survey respondents to flag cases where we may have received duplicate respondents. In cases where there appears to be duplicate respondents, we have deleted them. Also, to avoid violating assumptions of independence among observations from year to year, we have eliminated from our analyses data from respondents who indicated that they had previously responded to the survey.

Despite these limitations, we should note that (as described below) our samples were diverse in all three years. We achieved a wide range of respondents and the proportions of individuals from key demographic categories mirrors the target population characteristics well. Moreover, as we will discuss below, our study findings reflect trends that have been found in other recent studies.

Therefore, we are confident that despite the limitations described here, the study findings are valid and worthy of discussion.

Study Instruments

The purpose of the surveys was to gather data regarding target users' attitudes and knowledge about engineering as a career for girls, as well as users' behavior and self-reported behavioral intentions with respect to choosing engineering as a career (girls) or encouraging girls to choose engineering as a career (career counselors, engineers). The purpose of the partner interviews was to learn how effectively the initiative has been implemented and provide formative data to WGBH regarding potential ways to continuously improve the initiative and its perceived impact.

Engineer Survey

The online survey for engineers included questions designed to provide insight into: 1) why engineering is an appealing profession, 2) general stereotypes and how females are perceived in the industry and 3) information engineers would offer to students interested in pursuing an engineering career. The engineer survey included the following questions:

Questions about EYL

- Do you recall hearing about Engineer Your Life (EYL) before today?
- How did you hear about the Engineer Your Life (EYL) website?
- What was the best area of the website?
- Did the website do a good job showing what life and work are like for different engineers?
- Did the website help you feel more comfortable if you want to prepare high school girls to become an engineer (for example, helping them learn what classes they can take, how they should prepare for college)?
- Would you recommend this site to a student who is interested in learning more about engineering?
- How much, do you think, this website helps kids learn about engineering?
- Do you think this website helps kids understand that an engineering career is achievable?
- Do you think the website does a successful job of introducing high school girls to young women engineers?
- Which of the following activities do you plan to do to help female students learn more about engineering?
- How likely are you to use the Engineer Your Life resources to train other engineers about how to talk to high school girls about engineering?
- Have you used any of the Engineer Your Life resources already?
- How useful were they?
- Will you visit this website again?
- Would you tell your colleagues to visit this website?

Experience in the Engineering Industry

- What do you consider to be the best things about your life as an engineer?
- When did you decide to become an engineer?
- Did you have any female role models who were engineers when you were in school or when you were starting your career?
- Did you have any male role models who were engineers when you were in school or when you were starting your career?
- In your opinion, are females accepted as equals by their peers in the field of engineering?
- Which of the following do most people think are stereotypical characteristics of engineers?
- In your opinion, which of the stereotypes about engineers are true?
- Why are there not more women engineers?
- What do you think are the barriers to women entering into engineering as a career?

Experience with Students/Career Counseling

- In your opinion, at what grade level should students be encouraged to start pursuing an engineering career?
- Have any students asked you to mentor them or give them career advice?
- Which of the following educational programs have you participated in?
- In the future, which of the following educational programs do you plan to participate in?

- Please pretend that you are speaking to a group of female students about the life of an engineer. The following is a list of subjects that students may ask about. Please rank the items from 1-13 in the box next to the subject. "1" is the characteristic that you think is the most important to discuss with students and "13" is the least important characteristic.
- Which of the following statements are important for high school girls to know?
- If you met a high school girl who was interested in engineering, what advice would you give her?
- If you met a high school boy who was interested in engineering, what advice would you give him?
- If you could tell female high school students one thing about your experiences as an engineer, what would it be?

Background

- What is your gender?
- What is your job title?
- What is the highest level of education you completed?
- How many years have you been in the engineering industry?
- Did you participate in this survey last year?

Career Counselor/Educator Survey

The career counselor/educator survey included a set of questions designed to provide insight into: 1) how many female students were currently expressing interest in engineering, 2) the engineering opportunities offered in schools around the country, 3) the extent to which counselors are involved in these engineering opportunities, 4) stereotypes surrounding and attitudes toward women pursuing engineering careers, and 5) the counselors' ability to demonstrate an understanding of engineering. The survey included the following questions:

Questions about EYL

- Do you recall hearing about Engineer Your Life (EYL) before today?
- How did you hear about the Engineer Your Life (EYL) website?
- What was the best area of the website?
- How much did the website change your own level of interest in engineering?
- How much did the website help you learn about engineering and what resources and training to provide to students?
- Did the website do a good job showing what life and work are like for different engineers?
- Did the website help you understand what you should do if you want to prepare high school girls to become an engineer (for example, what classes they can take, how they should prepare for college)?
- Would you recommend this site to a student who is interested in learning more about engineering?
- How much, do you think, this website helps kids learn about engineering?
- Do you think this website helps kids understand that an engineering career is achievable?

- Do you think the website does a successful job of introducing high school girls to young women engineers?
- Would you tell your colleagues to visit this website?
- Will you visit this website again?
- Which of the following resources might you use when advising your students?
- Have you used any of the Engineer Your Life resources already?
- How useful were they?
- Which of the following will you recommend to a female student who is interested in learning more about engineering?

Career Counseling

- Approximately what percentage of the female students at your school discuss career opportunities with you?
- Approximately what percentage of the male students at your school discuss career opportunities with you?
- To what extent are your students' parents encouraged by the school to be involved in their child's career plans?
- On average, to what extent do you think the students in your school are aware of engineering career opportunities?
- On average, to what extent do you think engineering careers appeal to the students at your school?
- What percentage of female students at your school have expressed an interest in becoming an engineer?
- What percentage of male students at your school have expressed an interest in becoming an engineer?

Engineering Knowledge and Attitudes

- To what extent do you feel knowledgeable about engineering career opportunities?
- In your opinion, which of the following subjects will students need to study in college in order to pursue an engineering degree?
- Which of the following characteristics are important in order to be a successful engineer?
- In your opinion, what do engineers do?
- Which of the following was / were accomplished by an engineer?
- Please respond to the following statements.
    - (On a scale of 1-5, where 1=Strongly Disagree and 5=Strongly Agree). On average, boys are better at math and science than girls.
    - (Using a scale of 1-5, where 1=Strongly Disagree and 5=Strongly Agree): On average, boys are more suited for engineering than girls.
    - (Using a scale of 1-5, where 1=Strongly Disagree and 5=Strongly Agree): On average, boys are more encouraged to pursue engineering than girls.
    - (Using a scale of 1-5, where 1=Not Confident at All and 5=Very Confident): How confident are you that women can succeed in an engineering high school curriculum?
    - (Using a scale of 1-5, where 1=Not Confident at All and 5=Very Confident): How confident are you that women can succeed in an engineering college curriculum?

    - (Using a scale of 1-5, where 1=Not Confident at All and 5=Very Confident): How confident are you that women can succeed in an engineering career?
- What do you think are the barriers to women entering into engineering as a career?
- What aspects of education have a negative impact on girls pursuing an engineering career?

Background

- What is your gender?
- What grades do you work with?
- What state is your school in?
- Which of the following best describes the area in which your school is located?
- Which of the following best describes your school?
- What education and/or certification do you hold?
- How many years have you worked as a guidance/career counselor?
- What engineering programs are offered at your school?
- In the past, which activities have you participated in, organized, or been involved in?
- In the future, which activities do you plan to participate in, organize, or be involved in?
- Did you participate in this survey last year?
- Which best describes your role?

College-bound, Female, High School Student Survey

The student survey included a set questions designed to provide insight into students': 1) extracurricular activities, 2) exposure to engineering classes, curricula, clubs and mentors, 3) interest in specific industries and job characteristics, 4) ability to demonstrate an understanding of engineering, and 5) behavioral intentions of pursuing a career in engineering. The student survey contained the following questions:

Questions about EYL

- Do you recall hearing about Engineer Your Life (EYL) before today?
- Where have you heard about Engineer Your Life (EYL)?
- What was the best area of the site?
- How much did the website help you learn about engineering?
- How much did the website change your level of interest in engineering as a career?
- How much did the website inspire you to take engineering classes in college?
- Did the website help you understand what you should do if you want to become an engineer (for example, what classes to take, how to prepare for college)?
- Would you tell your friends to visit this site?

Career Interests and Plans

- Which of the following jobs would you be interested in being when you get older?
- What job characteristics are important to you for your future job?
- What subjects are important for you to use in your future job?
- How interested are you in the following jobs?

- Has anyone told you that you should pursue a career in engineering?
- If yes, why do they think you should pursue a career in engineering?
- Has anyone told you that you should NOT pursue a career in engineering?
- How likely is it that you will take an engineering class in college?
- How likely is it that you will pursue a career in engineering?
- How likely is it that one or more of your friends will pursue a career in engineering?
- Imagine that you just won first place in your school's writing competition. What would you do?
- Imagine that you just won first place in your school's science fair. What would you do?

Engineering Knowledge and Attitudes

- What subjects might engineers study in college?
- True or false: You must get a master's degree to become an engineer.
- In your opinion, which of the following characteristics are important in order to be a successful engineer?
- In your opinion, what do engineers do?
- True or false: Women can succeed in an engineering career.

Background

- How old are you?
- What grade are you in?
- What is your gender?
- What state do you go to school in?
- Which of the following best describes the place where you live?
- Which of the following best describes your school?
- Is your school an all girls' high school?
- Which of the following best describes your race/ethnicity?
- Do you have Internet access at home?
- In one week, approximately how much time do you spend on the Internet?
- Does your school offer any of the following engineering classes or extracurricular activities?
- Do you participate in any of these classes or activities?
- While in high school, have you participated in any of the following activities?
- Did you participate in this survey last year?

Coalition Partner Interviews

The partner interviews included a set of questions designed to help assess the impact of EYL. The partner interviews consisted of the following questions:

- Please tell me when, how, and why your organization got involved with the EYL coalition.
- What are the goals of your organization and how, if at all, has EYL helped you further your own goals and objectives?

- How are you using the EYL messages and other resources at your organization? For example, are you using the website, videos, Facebook, blog, or print materials? Are you using information you've gathered at trainings?
- Do you expect that your involvement/use of EYL will change in the future? If so, how?
- How satisfied are you that EYL is achieving its goals? Please explain (whether satisfied or not)? What are they doing well?
- How satisfied are you with the extent of EYL's outreach to academically-prepared girls? Please explain (whether satisfied or not)?
- What impact do you see EYL having – do you have any data you could share to support this?
- To what extent have you reached out to other organizations / partnerships about the coalition and initiative?
- Is there anything you would like to change about the coalition or the EYL initiative? What can they do better?

Study Participants

To date, the study sample has included counselors, educators, engineers, and college-bound female students from all regions of the United States and a small sample from Canada, Mexico, and the US Virgin Islands. The total number of participants is summarized in Table 2 below. We should note that the samples are independent from Year 1 to Year 2; in other words, we only included individuals in Year 2 who had *not* responded to the survey in Year 1.

Table 2:

Number of Study Participants[10]

Target Population	Year 1 Sample Size	Year 2 Sample Size	Year 3 Sample Size
Counselors and educators	147	171	177
Engineers	401	411	375
College-bound, female students	1,824[11]	707	617
EYL partners	N/A	10	7

We recruited survey respondents through contacts at relevant organizations and associations as well as the EYL website. Individuals who received the recruitment advertisements circulated the information via listserv postings, electronic bulletin boards, word-of-mouth, flyers and emails to all of their members. The following is a list of groups that assisted in the recruitment process:

> **Engineers:** Society of Women Engineers (SWE), American Society of Civil Engineers (ASCE), Women in Engineering Programs and Advocate Networks (WEPAN), IEEE, Deans of engineering schools
>
> **Career Counselors and Educators:** National Association for College Admission Counseling (NACAC), American School Counselor Association (ASCA), Computer Science Educators Association
>
> **College-bound, female high school students:** National Association for College Admission Counseling (NACAC), Educators Domain, National Girls Collaborative Project, Girl Scouts, Aerospace Scholars Program, GEAR UP, afterschool programs, Computer Science Educators Association

In addition, we distributed recruitment text via email to individuals who previously visited WGBH at college fairs. Also, we targeted college-bound, female high school students by

[10] In Years 2 and 3, we asked respondents whether they had previously participated in the EYL survey in Year 1. Only a handful of respondents responded affirmatively. These respondents were not included in data analyses, to avoid violating statistical assumptions of independence of the observations across the years.

[11] We cannot explain the significant difference in sample sizes for the student population. As with any study recruitment effort that relies on Web traffic to deliver messages to members of the target population, it is likely that the invitation was simply seen by more students in Year 1 than in Years 2 or 3.

posting advertisements on the “facebook” social networking website and various teen / student online forums. We targeted counselors and engineers by posting advertisements on the LinkedIn professional networking website.

We also contacted Technology Student Association regional coordinators, student delegation contacts, and State Technology Education Association high school regional contacts in nearly all 50 states, as well as high school technology education and engineering departments as identified through the ITEA networking lists to recruit counselors and students.

Student Findings

Participant Characteristics

In Year 1, 1,824 female high school students participated in the study. In Year 2, 707 students participated in the study. In Year 3, 617 students participated. The following two tables summarize the students' demographics. Students ranged in age from 13 to 19 years of age. The average age of students in the three cohorts (Year 1, Year 2, and Year 3) were: 16.23, 16.39, and 16.45, respectively. The Year 1 sample was statistically significantly younger than the Year 2 and 3 samples ($F_{(2, 3137)} = 10.583$, $p = .000$).

The grades in the sample ranged from 7th to 12th. The Year 1 sample contained a significantly smaller proportion of African-American and Hispanic students and a larger proportion of white students compared to the samples in Years 2 and 3.

Most students in the samples reporting having access to the Internet at home, and most students reported using the Internet for more than six hours per week, with no significant differences between the years.

Table 3:

Student Demographic Data

Characteristic	Year 1 Frequency & Percentage (N = 1,824)	Year 2 Frequency & Percentage (N = 707)	Year 3 Frequency & Percentage (N = 617)
Age**			
Thirteen	22 (1.2%)	15 (2.1%)	20 (3.2%)
Fourteen	103 (5.6%)	24 (3.4%)	36 (5.8%)
Fifteen	318 (17.4%)	89 (12.6%)	78 (12.6%)
Sixteen	532 (29.2%)	180 (25.5%)	161 (26.1%)
Seventeen	690 (37.8%)	294 (41.6%)	208 (33.7%)
Eighteen	149 (8.2%)	87 (12.3%)	102 (16.5%)
Nineteen	10 (0.5%)	10 (1.4%)	12 (1.9%)
Unknown (Missing data)	0 (0.0%)	8 (1.1%)	0 (0.0%)
Grade Levels			
Seventh	9 (0.5%)	4 (0.6%)	9 (1.5%)
Eighth	12 (0.7%)	16 (2.3%)	17 (2.8%)
Ninth	185 (10.0%)	35 (5.0%)	53 (8.6%)
Tenth	362 (19.8%)	121 (17.1%)	117 (19.0%)
Eleventh	576 (31.6%)	289 (40.9%)	173 (28.0%)
Twelfth	670 (36.7%)	234 (33.1%)	248 (40.2%)
Unknown (Missing data)	10 (0.5%)	8 (1.1%)	0 (0.0%)
Race/Ethnicity			
African American or Black**	185 (10.1%)	95 (13.4%)	93 (15.1%)
American Indian or Alaskan Native	48 (2.6%)	15 (2.1%)	23 (3.7%)
Asian or Pacific Islander	301 (16.5%)	109 (15.4%)	110 (17.8%)
Caucasian or White**	1307 (71.7%)	449 (63.5%)	371 (60.1%)
Latin American or Hispanic**	147 (8.1%)	80 (11.3%)	80 (13.0%)
Other (Unspecified multiracial)	7 (0.4%)	0 (0.0%)	7 (1.1%)

Characteristic	Year 1 Frequency & Percentage (N = 1,824)	Year 2 Frequency & Percentage (N = 707)	Year 3 Frequency & Percentage (N = 617)
Internet at Home			
Yes	1760 (96.5%)	684 (96.7%)	597 (96.8%)
No	54 (3.0%)	15 (2.1%)	20 (3.2%)
Unknown (Missing data)	10 (0.5%)	8 (1.1%)	0 (0.0%)
Time Spent on Internet per week			
Don't use Internet	5 (0.3%)	0 (0.0%)	2 (0.3%)
1 – 5 hours	584 (32.0%)	198 (28.0%)	187 (30.3%)
6 – 10 hours	620 (34.0%)	237 (33.5%)	193 (31.3%)
11 – 20 hours	410 (22.5%)	160 (22.6%)	140 (22.7%)
More than 20 hours	203 (11.1%)	101 (14.3%)	95 (15.4%)
Unknown (Missing data)	2 (0.1%)	0 (0.0%)	0 (0.0%)

Note: In some cases, percentages within a category add up to >100% because respondents were able to choose more than one answer.
* Significant at p < .05 level.
** Significant at p < .01 level.

The majority of students in our sample were from public schools (over 70%). The Year 3 sample contained a higher proportion of public school students and a lower proportion of private schools students compared to the Year 1 and 2 samples. The Year 1 sample contained a higher proportion of charter schools and a lower proportion of home-schooled students, than did the Year 2 and 3 samples.

Across all three samples, most students reported they were from suburban locations. The Year 1 sample contained a significantly smaller proportion of urban students and a significantly larger proportion of suburban and rural students than the Year 2 and 3 samples.

All the regions of the US were represented in the study. The Year 3 sample had significantly larger representation from the Northeast and the Midwest than the Year 1 and 2 samples.

Finally, there was a significantly higher proportion of students from all-girls schools in Year 2 versus Years 1 and 3.

When appropriate, our data analyses will control for key demographic and school characteristics since there are some differences in the samples across the years.

Table 4:

Schools' Demographic Data

Characteristics	Year 1 Frequency & Percentage (N = 1,824)	Year 2 Frequency & Percentage (N = 707)	Year 3 Frequency & Percentage (N = 617)
School Type**			
Public (non-charter)	1292 (70.8%)	500 (70.7%)	475 (77.0%)
Public charter	139 (7.6%)	34 (4.8%)	23 (3.7%)
Private or religious school	363 (19.9%)	151 (21.4%)	102 (16.5%)
Home school	21 (1.2%)	13 (1.8%)	17 (2.8%)
Unknown (Missing data)	9 (0.5%)	9 (1.3%)	0 (0.0%)
Locale**			
Urban	405 (22.2%)	203 (28.7%)	174 (28.2%)
Suburban	1059 (58.1%)	415 (58.7%)	342 (55.4%)
Rural	331 (18.1%)	81 (11.5%)	101 (16.4%)
Unknown (Missing data)	29 (1.6%)	8 (1.1%)	0 (0.0%)
Region[a]**			
Northeast US	534 (29.3%)	195 (27.6%)	120 (19.4%)
Southern US	564 (30.9%)	240 (33.9%)	192 (31.1%)
Midwest US	242 (13.3%)	108 (15.3%)	157 (25.4%)
Western US	424 (23.2%)	146 (20.7%)	139 (22.5%)
Pacific US	22 (1.2%)	6 (0.8%)	5 (0.8%)
Canada	8 (0.4%)	0 (0.0%)	4 (0.6%)
All Girls School**			
Yes	123 (6.7%)	85 (12.0%)	32 (5.2%)
No, co-ed	1685 (92.4%)	614 (86.8%)	579 (93.8%)
Unknown (Missing data)	16 (0.9%)	8 (1.1%)	6 (1.0%)

[a] Northeast includes ME, NH, VT, MA, CT, RI, NY, NJ, PA; South includes: MD, DE, DC, WV, VA, NC, SC, GA, FL, KY, TN, AL, MS, LA, AR, OK, TX, Virgin Islands, and Puerto Rico; Midwest includes: MI, WI, IL, IN, OH, ND, SD, NE, KS, MN, IA, MO; Western includes: MT, WY, ID, NV, UT, CO, AZ, NM, WA, OR, CA; Pacific includes: AK, HI.

* Significant at p < .05 level.

** Significant at p < .01 level.

School Experience

Students' Exposure to Engineering

We asked students to report which engineering programs their schools offered. The majority of schools in our samples did *not* offer engineering activities or mentors to students, including clubs, Women in Engineering Day, guest speakers or career fair representatives. Compounding the minimal availability of engineering activities, only 25% of students in Year 1, 21% of students in Year 2, and 23% of students in Year 3 reported they were exposed to engineering through general science curricula. Only 11% of Year 1 students and 12% of Year 2 students were able to take engineering classes, but 30% of the students in Year 3 reported that they were able to take an engineering class. The table below outlines the engineering programs available to students and the programs in which they reported participating.

Table 5: Student Involvement in Engineering-Related Programs

Engineering Programs	Year 1		Year 2		Year 3	
	Yes, I currently participate or have participated in this opportunity	My school does not offer this opportunity	Yes, I currently participate or have participated in this opportunity	My school does not offer this opportunity	Yes, I currently participate or have participated in this opportunity	My school does not offer this opportunity
Engineering activities / lessons as part of a general science class	446 (24.5%)**	806 (44.2%)	147 (20.8%)	530 (75.0%)	106 (17.2%)	475 (77.0%)
Engineers as guest speakers	256 (14.0%)**	1159 (63.5%)	65 (9.2%)	613 (86.7%)	51 (8.3%)	539 (87.4%)
Engineering classes / curricula	202 (11.1%)	876 (48.0%)	87 (12.3%)	525 (74.3%)	77 (12.5%)	435 (70.5%)
Engineering representatives at a career fair	156 (8.6%)**	1118 (61.3%)	48 (6.8%)	602 (85.1%)	30 (4.9%)	529 (85.7%)
Engineering clubs	95 (5.2%)**	1097 (60.1%)	93 (13.2%)	488 (69.0%)	72 (11.7%)	412 (66.8%)
Women in Engineering Day	56 (3.1%)	1508 (82.7%)	44 (6.2%)**	660 (93.4%)	20 (3.2%)	597 (96.8%)
Engineering or technology prep programs	0 (0.0%)	Unknown	57 (8.1%)	585 (82.7%)	39 (6.3%)	517 (83.8%)
Outreach from local universities	0 (0.0%)	Unknown	57 (8.1%)	595 (84.2%)	45 (7.3%)	520 (84.3%)
Building and design clubs	0 (0.0%)	Unknown	48 (6.8%)	523 (74.0%)	43 (7.0%)	457 (74.1%)
Project Lead the Way or other national programs	0 (0.0%)	Unknown	30 (4.2%)	656 (92.8%)	33 (5.3%)	546 (88.5%)

** Significant at $p < .01$ level.

Students in Year 1 were significantly more likely to have participated in or been exposed to engineering activities as part of a science class, guest engineers, and engineering representatives at career fairs, than students in Year 2 or 3. Students in Year 1 were also significantly less likely to participate in engineering clubs than the students in Year 2 and 3. Students in Year 2 were more likely to have participated in Women in Engineering Day than students in Year 1 and 3.

Students' Non-Engineering Extracurricular Activities

Outside of engineering, the student respondents were reportedly involved in a variety of extracurricular activities, including:

- 4-H
- Academic clubs and competitions (History club, writing, club, academic decathlon)
- Art-related clubs
- Band / orchestra / choir / a cappella group
- Business clubs / Delta epsilon chi association
- Career fair
- Cheerleading or dance team
- Colorguard / Flag team
- Community service / volunteering
- Dance club
- Debate team
- Diversity / Human rights groups
- Environmental organization
- Future Farmers of America
- Girl Scouts
- Junior Reserve Officers' Training Corps
- Key Club
- Language / Cultural groups
- Math team / Mathletes
- Mentoring / tutoring
- Mock trial
- Model United Nations
- National Honor Society
- Part-time job
- Political clubs
- Prom committee
- Religious groups
- Rotary Club
- School newspaper / Literary magazine
- Science fair
- "Shadowing" or observing a professional at work
- Sports team
- Student council or student government
- Students Against Drunk Driving
- Theater production
- Yearbook committee
- Women in Science Day

In all three years, there was a positive correlation between the number of extra-curricular activities in which students participated and their reported intentions to take an engineering class in college (Year 1 $r_{(1716)} = 0.121$, p = 0.000; Year 2 $r_{(698)} = 0.178$, p = 0.000; Year 3 $r_{(616)} = 0.156$, p = 0.000). The more activities students participated in, the more likely they were to report intentions to take an engineering class in college.

There was also a positive correlation between the number of extra-curricular activities students participated in and their reported intentions to pursue an engineering career (Year 1 $r_{(1714)} = 0.103$, p = 0.000; Year 2 $r_{(699)} = 0.137$, p = 0.000; Year 3 $r_{(616)} = 0.087$, p = 0.030). The more activities students participated in, the more likely they were to report intentions to pursue an engineering career.

Students who participated in more extracurricular activities were more likely to report that they believed their friends would pursue a career in engineering (Year 1 $r_{(1710)} = 0.194$, p = 0.000; Year 2 $r_{(699)} = 0.103$, p = 0.006; Year 3 $r_{(616)} = 0.200$, p = 0.000).

We found significant differences between student respondents who had participated in certain extracurricular activities and those who had not participated with respect to their intentions to pursue engineering classes or a career. For example, students who had participated in the following extracurricular activities were *more likely* to report intentions to take an engineering class in college than those who had not participated in the same activities:

- Band / orchestra / choir / a capella group (Year 1 $t_{(df=1714)} = -2.741$, p = 0.006)
- Building or design clubs (Year 1 $t_{(df=1715)} = -3.911$, p = 0.000; Year 2 $t_{(df=696)} = -2.005$, p = 0.045; Year 3 $t_{(df=615)} = -2.180$, p = 0.030)
- Community service (Year 1 $t_{(df=1714)} = -4.095$, p = 0.000; Year 2 $t_{(df=316.904)} = -3.501$, p = 0.001)
- Computer or Web design club (Year 1 $t_{(df=1715)} = -3.139$, p = 0.002; Year 2 $t_{(df=73.543)} = -2.652$, p = 0.010)
- Debate team (Year 1 $t_{(df=1714)} = -3.536$, p = 0.000; Year 3 $t_{(df=615)} = -1.983$, p = 0.048)
- Diversity club (Year 1 $t_{(df=1714)} = -2.440$, p = 0.015)
- Environmental organization (Year 1 $t_{(df=1714)} = -4.472$, p = 0.000; Year 3 $t_{(df=615)} = -2.131$, p = 0.034))
- Girl Scouts (Year $3_{(df=72.111)} = -2.914$, p = 0.005)
- Math team or Mathletes (Year 1 $t_{(df=1714)} = -6.546$, p = 0.000; Year 2 $t_{(df=302.129)} = -6.831$, p = 0.000; Year 3 $t_{(df=156.483)} = -5.540$, p = 0.000)
- Mentoring or tutoring (Year 1 $t_{(df=1714)} = -2.281$, p = 0.023; Year 3 $t_{(df=615)} = -3.116$, p = 0.002)
- Model UN (Year 1 $t_{(df=1714)} = -2.489$, p = 0.013)
- National Honor Society (Year 1 $t_{(df=1714)} = -3.979$, p = 0.000; Year 2 $t_{(df=680.743)} = -6.329$, p = 0.000)
- Science fair (Year 1 $t_{(df=1714)} = -3.817$, p = 0.000; Year 2 $t_{(df=219.347)} = -2.760$, p = 0.006; Year 3 $t_{(df=615)} = -2.096$, p = 0.036)
- Sports (Year 1 $t_{(df=1714)} = 15.111$, p = 0.000; Year 2 $t_{(df=679.290)} = -3.284$, p = 0.001; Year 3 $t_{(df=615)} = -2.440$, p = 0.015)
- Student government (Year 3 $t_{(df=615)} = -2.721$, p = 0.007)

- Women in Science Day (Year 1 $t_{(df=1715)} = -6.331$, p = 0.000; Year 3 $t_{(df=615)} = -2.274$, p = 0.023)

Also, students who had participated in the following extracurricular activities were *more likely* to report intentions to pursue a career in engineering than those who had not participated in the same activities:

- Band / orchestra / choir / a capella group (Year 1 $t_{(df=1712)} = -2.214$, p = 0.027)
- Building or design clubs (Year 1 $t_{(df=243.393)} = -3.939$, p = 0.000)
- Community service (Year 1 $t_{(df=1712)} = -2.589$, p = 0.010; Year 2 $t_{(df=697)} = -3.072$, p = 0.002)
- Computer or Web design club (Year 1 $t_{(df=199.491)} = -3.787$, p = 0.000; Year 2 $t_{(df=73.497)} = -2.223$, p = 0.029)
- Debate team (Year 1 $t_{(df=1712)} = -2.471$, p = 0.014)
- Diversity club (Year 1 $t_{(df=1712)} = -1.995$, p = 0.046)
- Drama (Year 2$_{(df=231.760)} = 2.135$, p = 0.034)
- Environmental organization (Year 1 $t_{(df=532.019)} = -3.513$, p = 0.000)
- Girl Scouts (Year 3$_{(df=615)} = -2.073$, p = 0.039)
- Math team or Mathletes (Year 1 $t_{(df=294.884)} = -5.119$, p = 0.000; Year 2 $t_{(df=256.387)} = -5.168$, p = 0.000; Year 3 $t_{(df=615)} = -5.405$, p = 0.000)
- Mentoring or tutoring (Year 3 $t_{(df=615)} = -2.505$, p = 0.013)
- National Honor Society (Year 1 $t_{(df=1153.769)} = -3.618$, p = 0.000; Year 2 $t_{(df=660.481)} = -5.566$, p = 0.000)
- Science fair (Year 1 $t_{(df=477.338)} = -3.399$, p = 0.001; Year 2 $t_{(df=697)} = -2.660$, p = 0.008)
- Sports (Year 1 $t_{(df=1420.435)} = -4.721$, p = 0.000; Year 2 $t_{(df=681.453)} = -3.430$, p = 0.001)
- Student government (Year 3 $t_{(df=615)} = -2.049$, p = 0.041)
- Women in Science Day (Year 1 $t_{(df=91.422)} = -5.521$, p = 0.000; Year 3 $t_{(df=615)} = -2.154$, p = 0.044)

In Year 1, students who had part-time jobs and students who worked on the school newspaper or literary magazine were *less likely* to report intentions to take an engineering class in college than students who did not work part-time or participate in these activities (Job $t_{(df=1714)} = 3.215$, p = 0.001; Newspaper $t_{(df=1714)} = 1.994$, p = 0.046; Magazine $t_{(df=16.593)} = 2.446$, p = 0.004). But, we did not observe these same differences in Year 2 or Year 3.

Career Interests and Plans

We asked students to respond to a series of questions about their career interests and plans.

Career Interests

Students cited many different careers that they would like to pursue. In Year 1, the top five choices were:

- Doctor (39.6%),[12]
- Educator (39.2%),
- Psychologist (34.6%),

[12] The proportions reported in Year 2 were slightly different, based on how missing data were handled. The number of students who reported the choices has not changed.

- Scientist (30.9%), and
- Business person (30.2%).

In Year 1, only 18% of the students expressed an interest in pursuing an engineering career. This finding mirrors the Counselor/Educator finding that fewer than 25% of counselors' students had expressed interest in becoming an engineer.

In Year 2, the top five choices were:

- *Engineer (65.2%),*
- Scientist (35.1%),
- Doctor (28.0%),
- Educator (22.9%), and
- Business person (21.6%).

In Year 3, the top five choices were:

- *Engineer (49.1%),*
- Scientist (32.6%),
- Doctor (28.2%),
- Business person and Psychologist (both 24.5%).

Most of the career interests were the same from Year 2 to Year 3 (see Table 6).

Table 6:

Career Interests

Occupation	Year 1 Frequency & Percentage (N = 1,824)	Year 2 Frequency & Percentage (N = 707)	Year 3 Frequency & Percentage (N = 617)
Doctor	723 (39.6%)**	202 (28.0%)	174 (28.2%)
Educator	715 (39.2%)**	163 (22.9%)	150 (24.3%)
Psychologist	632 (34.6%)**	152 (20.9%)	151 (24.5%)
Scientist	563 (30.9%)	250 (35.1%)	201 (32.6%)
Business person	550 (30.2%)**	156 (21.6%)	151 (24.5%)
Lawyer	512 (28.1%)**	118 (16.3%)	98 (15.9%)
Actor / actress	462 (25.3%)**	95 (13.0%)	78 (12.6%)
Musician	395 (21.7%)**	113 (15.8%)	96 (15.6%)
Engineer	329 (18.0%)**	466 (65.2%)	303 (49.1%)
Politician	249 (13.7%)**	59 (8.2%)	50 (8.1%)
I don't know	211 (11.6%)**	56 (7.9%)	51 (8.3%)
Sales representative	150 (8.2%)**	22 (3.1%)	30 (4.9%)
Artist	98 (5.4%)	34 (4.8%)	6 (1.0%)**
Author / Writer	64 (3.5%)	21 (3.0%)	31 (5.0%)
Journalist	46 (2.5%)**	7 (1.0%)	3 (0.5%)

Occupation	Year 1 Frequency & Percentage (N = 1,824)	Year 2 Frequency & Percentage (N = 707)	Year 3 Frequency & Percentage (N = 617)
Veterinarian	42 (2.3%)	8 (1.1%)	9 (1.5%)
Nurse / Physician Assistant	38 (2.1%)	9 (1.3%)	13 (2.1%)
Pharmacist	33 (1.8%)*	7 (1.0%)	3 (0.5%)
Architect	27 (1.5%)	16 (2.1%)	14 (2.3%)
Culinary artist / Chef	25 (1.4%)	6 (0.8%)	4 (0.6%)
Dancer / Performing artist	24 (1.3%)	5 (0.7%)	3 (0.5%)
Graphic / web designer	19 (1.1%)	14 (2.0%)	6 (1.0%)
Physical therapist	15 (0.8%)	2 (0.3%)	6 (1.0%)
Athlete / Sports-related	13 (0.7%)	2 (0.3%)	3 (0.5%)
Dentist / Orthodontist	13 (0.7%)	4 (0.6%)	4 (0.6%)
Social worker	12 (0.7%)	5 (0.7%)	1 (0.2%)
Accountant	6 (0.3%)	3 (0.4%)	1 (0.2%)
Computer scientist / Programmer	3 (0.2%)**	7 (1.0%)	6 (1.0%)

* Significant at $p < .05$ level.
** Significant at $p < .01$ level.

We found that engineering was significantly more likely to be chosen in Years 2 and 3, even when controlling for age, grade, locale, whether the student's school was an all-girls' school, and weekly Internet usage. Last year (Year 2) we reported that students were more interested in engineering in Year 2 than Year 1, regardless of whether they were familiar with EYL. This continued to hold true for Year 3.

As we argued last year, these findings add to the accumulating evidence from other recent studies which point to a growing level of interest nationally among academically-prepared young women with respect to field of engineering. A survey conducted in 2009 by the National Academies of Engineering found that 41% percent of female high school respondents who participated in an *EngineerGirl!* essay contest reported that they would be studying engineering in college, and that 40% were interested in engineering.[13] Another study, sponsored by the National Engineers Week Foundation and the Global Marathon found that "…while 38% of girls plan to pursue a career in the sciences, an almost equal number (39%), feel they are not getting a proper STEM education. Significantly, 75% of girls think they will use math in a future job and 61% thought they would use science in a future job. Only 18% of girls agreed strongly that they

[13] Jenniches, S. & Didion, C. (Sep 2009). EngineerGirl!: A website to interest girls in engineering. *The Bridge, 39(3)*. Available online at http://www.nae.edu/Publications/TheBridge/Archives/16145/16221.aspx

were being 'prepared to take on the challenges facing the nation,' when they compared themselves to their peers in other countries."[14]

There may even be growing interest beyond the academically-prepared students. For example, in 2009, Junior Achievement USA surveyed a national sample of teens (not controlling for whether the teens intended to attend college) and found that "engineer" tied with "doctor" for teens' first career choice.[15]

When we examined the Year 2 and 3 students more closely, we found that although many students in Year 2 and 3 were interested in engineering, students who reported that they were familiar with EYL were significantly *more likely* to report that they wanted to be engineers (78.8% in Year 2 and 71.9% in Year 3) than students in Year 2 who were unfamiliar with EYL (57.3% in Year 2 and 43.9% in Year 3) (Year 2 $\chi^2_{(df=1)} = 23.211$, $p = 0.000$; Year 3 $\chi^2_{(df=1)} = 28.031$, $p = 0.000$).

Note that the difference from Year 2 to Year 3 was not statistically significant for students who were familiar with EYL. That is, the decrease from 78.8% to 71.9% is not a statistically significant drop, indicating that the level of interest in engineering among students familiar with EYL was sustained over time. Whereas, the difference from Year 2 to 3 for students who were unfamiliar with EYL was significant. Students who were unfamiliar with EYL were significantly less interested in engineering this year than last ($\chi^2_{(df=1)} = 16.740$, $p = 0.000$).

Future Job Characteristics

Regardless of job title, certain job characteristics were important to students for their future job. The most frequently cited goals across all the years were to: 1) have fun, 2) have time for family and friends as well as work and 3) be successful, followed closely by 4) contribute to society / make a difference in people's lives.

The table below summarizes the job characteristics that the students considered important.

Table 7:

Job Characteristics that were Important to Students

Job Characteristics	Year 1 Frequency & Percentage (N = 1,824)	Year 2 Frequency & Percentage (N = 707)	Year 3 Frequency & Percentage (N = 617)
Have fun	1608 (88.2%)**	587 (83.0%)	500 (81.0%)
Have time for family and friends as well as work	1600 (87.7%)**	556 (78.6%)	485 (78.6%)
Be successful	1533 (84.0%)**	546 (77.2%)	475 (77.0%)
Contribute to society/make a difference in people's lives	1443 (80.4%)**	523 (74.0%)	466 (75.5%)

[14] National Engineers Week Foundation (March 10, 2010). *New Survey Finds American Girls Express Interest in Sciences but aren't Sure How to Get There.* Press release available online at http://www.eweek.org/NewsStory.aspx?ContentID=209

[15] Junior Achievement USA (January 29, 2009). Poll shows less interest in "business person" careers. Downloaded on September 16, 2009 from http://www.ja.org/about/releases/about_newsitem526.asp

Job Characteristics	Year 1 Frequency & Percentage (N = 1,824)	Year 2 Frequency & Percentage (N = 707)	Year 3 Frequency & Percentage (N = 617)
Think creatively	1298 (79.1%)**	471 (66.6%)	389 (63.0%)
Work with talented people	1292 (70.8%)**	462 (65.3%)	379 (61.4%)
Be challenged	1269 (69.6%)**	464 (65.6%)	400 (64.8%)
Have a lot of choices of what to do in my field/industry	1045 (57.3%)	411 (58.1%)	341 (55.3%)
Make a lot of money	1040 (57.0%)	398 (56.3%)	337 (54.6%)
Travel around the world	945 (51.8%)**	351 (49.6%)	285 (46.2%)
Work as part of a team	904 (49.6%)**	300 (42.2%)	249 (40.4%)
Have a job that other people think is important	720 (39.5%)**	263 (37.2%)	206 (33.4%)
Use math and science skills	702 (38.5%)**	416 (58.8%)	301 (48.8%)
Use English and writing skills	658 (30.1%)**	160 (22.6%)	157 (25.4%)
Organize and manage projects	613 (33.6%)	245 (34.7%)	187 (30.3%)
Design and build solutions to problems	483 (26.5%)**	338 (47.8%)	259 (42.0%)
Have a job that other people think is cool	426 (23.4%)	171 (24.2%)	130 (21.1%)
Work with computers	368 (20.2%)**	186 (26.3%)	137 (22.2%)
Work alone	354 (19.4%)	145 (20.5%)	113 (18.3%)

Note: Percentages add up to >100% because respondents were able to choose more than one answer.
* Significant at p < .05 level.
** Significant at p < .01 level.

There were significant differences between student respondents who wanted certain job characteristics and those who did not want certain characteristics with respect to their interest in an engineering career. For example, students who wanted to have the following job characteristics were *more likely* to express interest in becoming an engineer than students who did not want the same job characteristics:

- Make a lot of money (Year 1 $t_{(df=152.503)} = -2.345$, p = 0.019)
- Use math and science skills (Year 1 $t_{(df=1151.694)} = -15.164$, p = 0.000; Year 2 $t_{(df=503.045)} = -14.435$, p = 0.000; Year 3 $t_{(df=615)} = -11.938$, p = 0.000)
- Have a lot of choices of what to do in an industry (Year 1 $t_{(df=1598.201)} = -3.664$, p = 0.000; Year 2 $t_{(df=571.337)} = -2.562$, p = 0.011)
- Be challenged (Year 1 $t_{(df=1026.965)} = -5.400$, p = 0.000; Year 2 $t_{(df=443.286)} = -5.299$, p = 0.000; Year 3 $t_{(df=480.312)} = -4.033$, p = 0.000)
- Work with talented people (Year 1 $t_{(df=920.247)} = -2.439$, p = 0.015)
- Work with computers (Year 1 $t_{(df=502.448)} = -7.039$, p = 0.000; Year 2 $t_{(df=395.004)} = -5.878$, p = 0.000; Year 3 $t_{(df=615)} = -3.460$, p = 0.000)
- Design and build solutions to problems (Year 1 $t_{(df=680.606)} = -11.591$, p = 0.000; Year 2 $t_{(df=676.799)} = -12.435$, p = 0.000; Year 3 $t_{(df=615)} = -11.524$, p = 0.000)

- Organize and manage projects (Year 1 $t_{(df=1050.518)} = -5.573$, p = 0.000; Year 2 $t_{(df=553.813)} = -5.735$, p = 0.000; Year 3 $t_{(df=615)} = -3.215$, p = 0.000)
- Be creative (Year 1 $t_{(df=905.889)} = -2.218$, p = 0.027; Year 2 $t_{(df=455.077)} = -2.204$, p = 0.044; Year 3 $t_{(df=615)} = -3.923$, p = 0.000)
- Work with a team (Year 1 $t_{(df=1710.984)} = -2.274$, p = 0.023; Year 2 $t_{(df=697)} = -3.088$, p = 0.002; Year 3 $t_{(df=615)} = -2.147$, p = 0.032)

In contrast, students across all three years who wanted to use English and writing skills were significantly *less likely* to express interest in becoming an engineer than students who did not want to use English and writing skills (Year 1 $t_{(df=1469.919)} = 4.597$, p = 0.000; Year 2 $t_{(df=697)} = -4.329$, p = 0.000; Year 3 $t_{(df=615)} = -1.935$, p = 0.053).

School Subjects

In addition to job characteristics, the student respondents chose school subjects that they would like to use in their future career. In Year 1, writing, math and science were listed as the most common school subjects that students wanted to use in their future jobs. Only 17.5% of Year 1 respondents were interested in using engineering in their future careers.

In Years 2 and 3, however, the top three choices were math, science, and engineering. Students in Year 2 and 3 were significantly *more likely* than Year 1 students to pick engineering, even when controlling for age, grade, locale, whether the student's school was an all-girls' school, and weekly Internet usage. As described at the end of this section, students who were familiar with EYL were significantly *more likely* to report that they wanted to use math, science, and engineering in their future jobs than students who were unfamiliar with EYL.

Table 8:

School Subjects that Students Would Like to Use in their Future Job

Subjects	Year 1 Frequency & Percentage (N = 1,824)	Year 2 Frequency & Percentage (N = 707)	Year 3 Frequency & Percentage (N = 617)
Writing	1088 (59.6%)**	294 (41.6%)	287 (46.5%)
Math	1026 (56.3%)**	528 (74.7%)	412 (66.8%)
Science	1016 (55.7%)**	497 (70.3%)	388 (62.9%)
Psychology or sociology	851 (46.7%)**	195 (27.6%)	206 (33.4%)
Literature / Creative writing	697 (38.2%)**	159 (22.5%)	179 (29.0%)
Arts	657 (36.0%)**	192 (27.2%)	184 (29.8%)
History	521 (28.6%)**	135 (19.1%)	130 (21.1%)
Legal studies / Law	414 (22.7%)**	77 (10.9%)	85 (13.8%)
Engineering	315 (17.3%)**	396 (56.0%)	274 (44.4%)
Foreign languages[a]	24 (1.3%)	5 (0.7%)	233 (37.8%)
Health and anatomy[a]	17 (0.9%)	2 (0.3%)	198 (32.1%)

Subjects	Year 1 Frequency & Percentage (N = 1,824)	Year 2 Frequency & Percentage (N = 707)	Year 3 Frequency & Percentage (N = 617)
Business and economics[a]	10 (0.5%)	4 (0.6%)	158 (25.6%)
Computer science and programming[a]	10 (0.5%)	4 (0.6%)	173 (28.0%)

Note: Percentages add up to >100% because respondents were able to choose more than one answer.
* Significant at p < .05 level.
** Significant at p < .01 level.
[a] These options were added to the Year 3 survey, but were extracted from students' "other" responses in Year 1 and 2. In other words, these options were not included in the Year 1 and Year 2 surveys. So, the large difference should not be interpreted to mean that there was a significantly greater level of interest in Year 3 (and we have not run a statistical analysis for these options).

Students' Intentions to Pursue Engineering

In Year 1, only 22.7% of the student respondents reported that they were "very likely" or "likely" to take an engineering class in college versus 64.7% of students in Year 2 and 52.1% of students in Year 3. This difference was significant ($\chi^2_{(df=8)} = 534.349$, p = 0.000).

In Year 1, only 10.6% of respondents reported that they were "very likely" or "likely" to pursue a career in engineering versus 52.4% of students in Year 2 and 40% of students in Year 3. This difference was also significant ($\chi^2_{(df=8)} = 594.396$, p = 0.000).

In Years 2 and 3, student intentions to pursue a career in engineering were related to whether or not someone in the students' lives encouraged them to pursue such a career (e.g., a parent or educator) (Year 2 $t_{(df=370.234)} = -16.303$, p = 0.000; Year 3 $t_{(df=568.912)} = -18.358$, p = 0.000). That is, students who were encouraged to pursue engineering were likely to indicate intentions to do so than students who were not encouraged.

Across the three years, more than half the students reported that *one or more of their friends* was "very likely" or "likely" to pursue a career in engineering (54.7%, 55.2%, and 56.7%, respectively).

In Year 1, 61% of students realized that a master's degree was unnecessary for a career in engineering. In Years 2 and 3, 72% of students realized that a master's degree was unnecessary for an engineering career.[16]

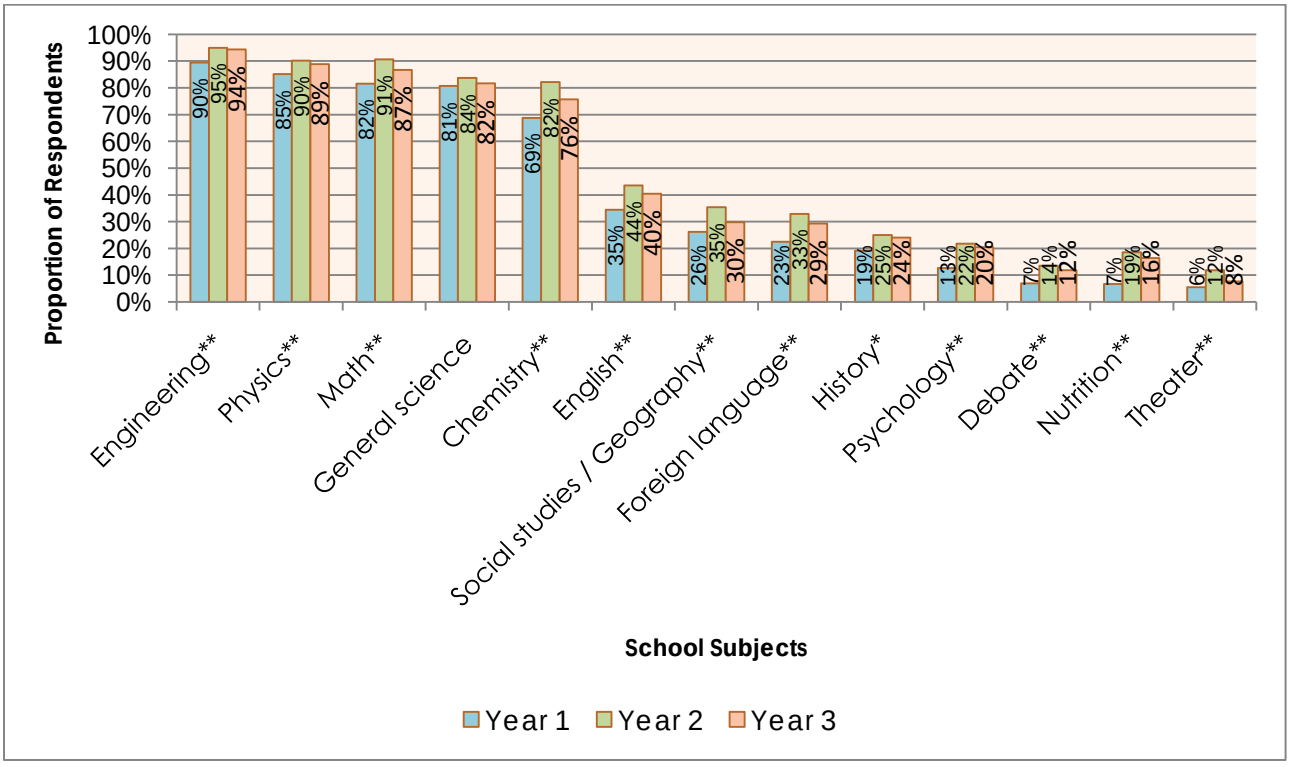
Engineering Knowledge and Attitudes

We asked students to respond to a series of questions to measure their current knowledge level of engineering, as well as their current attitudes toward the industry. It is important to note that across all three years, 99% of students agreed that women can succeed in an engineering career.

[16] In our Year 2 report, we reported the percentage of students who thought that a master's degree was *necessary*, rather than the percent who thought it was *unnecessary*.

Knowledge of School Subjects Needed for Engineering

We asked the student respondents which subjects engineers might study in college. Similar to the Counselor/Educator findings, the majority of participants were familiar with engineering, physics, math, general science and chemistry requirements. While fewer than half of the students across both years were aware of the need for a more diverse portfolio, including English, social studies, psychology and public speaking opportunities such as debate and theater, students in Year 2 and 3 were significantly *more likely* than students in Year 1 to recognize the importance of the non-science subjects. The figure below presents the school subjects students reported engineers should study in college.



Note: Percentages add up to >100% because respondents were able to choose more than one answer.
* Significant at the p < .05 level.
** Significant at the p < .05 level.

Figure 1. School Subjects that Students Believe are Important for Engineering

Across all three years, there were significant differences between students who reported that engineers might study certain subjects and those who reported that engineers do not need certain subjects with respect to the students' intentions to pursue engineering. Students who reported that engineers might study the following subjects were *more likely* to report that they might pursue an engineering career than those who did not think engineers might study the following:

- English ($t_{(df=3054)}$ = -7.425, p =.000)
- Psychology ($t_{(df=3054)}$ = -6.455, p =.000)
- Foreign languages ($t_{(df=3054)}$ = -9.219, p =.000)

- Chemistry ($t_{(df=3054)}$ = -10.685, p =.000)
- Debate ($t_{(df=3054)}$ = -6.148, p =.001)
- Math ($t_{(df=584.454)}$ = -11.185, p =.000)
- Nutrition ($t_{(df=196.138)}$ = -6.721, p =.000)

Knowledge of Job Skills Needed for Engineering

The students cited many characteristics they considered important to becoming a successful engineer. Many of the frequently cited characteristics are similar to the subjects discussed above; the majority of students reported that math, science, computer, machinery and problem solving skills were important, while people and public speaking skills were cited less frequently. However, attention to detail and imagination and creativity were also recognized as important skills, especially in Years 2 and 3. The table below summarizes the skills that students cited as important to becoming a successful engineer.

Table 9:

Skills Students Believe are Important to Engineers

Skills Needed	Year 1 Frequency & Percentage (N = 1,824)	Year 2 Frequency & Percentage (N = 707)	Year 3 Frequency & Percentage (N = 617)
Attention to detail	1582 (86.7%)	633 (89.5%)	578 (91.0%)
Good problem solving skills	1576 (86.4%)**	649 (91.8%)	595 (93.7%)
Ability in math	1549 (84.9%)**	643 (90.9%)	573 (90.2%)
Ability in science	1461 (80.1%)**	619 (87.6%)	534 (84.1%)
Ability to work with machines	1453 (79.7%)	527 (74.5%)*	498 (78.4%)
Good computer skills	1389 (76.2%)	546 (77.2%)	499 (78.6%)
Imagination and creativity	1298 (71.2%)**	605 (85.6%)	531 (83.6%)
Ability to work alone	919 (50.4%)	348 (49.2%)	319 (50.2%)
Good people skills	763 (41.8%)**	389 (55.0%)	313 (49.3%)
Good writing skills	651 (35.7%)**	330 (46.7%)	263 (41.4%)
Good public speaking skills	518 (28.4%)**	285 (40.3%)	238 (37.5%)
Ability to work in groups[a]	5 (0.3%)	8 (1.1%)	507 (79.8%)
Determination[a]	2 (0.1%)	4 (0.6%)	547 (86.1%)

Note: Percentages add up to >100% because respondents were able to choose more than one answer.
* Significant at p < .05 level.
** Significant at p < .01 level.
[a] These options were added to the Year 3 survey, but were extracted from students' "other" responses in Year 1 and 2. In other words, these options were not included in the Year 1 and Year 2 surveys. So, the large difference should not be interpreted to mean that there was a significantly greater level of interest in Year 3 (and we have not run a statistical analysis for these options).

Students cited many characteristics they considered important to becoming a successful engineer. Many of the frequently cited characteristics were similar to the subjects discussed above; the majority of students reported that math, science, computer, machinery and problem solving skills were important, while people and public speaking skills were cited less frequently. Students in Year 2 and 3 were more likely than Year 1 students to believe that the following skills were important to engineers:

- Good problem solving skills,
- Math ability,
- Science ability,
- Imagination and creativity,
- Good people skills,
- Good writing skills, and
- Good public speaking skills.

In Year 2, we found that students who were familiar with EYL were *more likely* than students who were unfamiliar with EYL to believe that the following skills were important to engineers:

- Imagination and creativity ($\chi^2_{(df=2)} = 6.755$, $p = 0.034$)
- Good people skills ($\chi^2_{(df=2)} = 7.424$, $p = 0.024$)
- Good writing skills ($\chi^2_{(df=2)} = 10.274$, $p = 0.006$)
- Good public speaking skills ($\chi^2_{(df=2)} = 10.120$, $p = 0.006$)

In Year 3, we found that students who were familiar with EYL were *more likely* than students who were unfamiliar with EYL to believe that the following skills were important to engineers:

- Imagination and creativity ($\chi^2_{(df=1)} = 7.886$, $p = 0.005$)
- Good people skills ($\chi^2_{(df=1)} = 7.424$, $p = 0.024$)
- Good public speaking skills ($\chi^2_{(df=1)} = 6.418$, $p = 0.011$)

Knowledge of Engineering Job Roles

We asked the students to cite job roles they associated with engineering careers. The following table summarizes the engineering job roles and the proportion of students who cited each.

Table 10:

Roles that Students Associated with Engineering

Job Roles	Year 1 Frequency & Percentage (N = 1,824)	Year 2 Frequency & Percentage (N = 707)	Year 2 Frequency & Percentage (N = 617)
Use their math and science skills	1566 (85.9%)**	642 (90.8%)	561 (90.9%)
Make a lot of money	1487 (81.5%)**	347 (49.1%)	322 (52.2%)
Organize and manage projects	1350 (74.0%)**	565 (79.9%)	492 (79.7%)

Job Roles	Year 1 Frequency & Percentage (N = 1,824)	Year 2 Frequency & Percentage (N = 707)	Year 2 Frequency & Percentage (N = 617)
Design equipment	1317 (72.2%)**	557 (78.8%)	549 (89.0%)
Sometimes work with other professions	1289 (70.7%)**	543 (76.8%)	469 (76.0%)
Think creatively	1250 (68.5%)**	586 (82.9%)	510 (82.7%)
Work as part of a team	1225 (67.2%)**	540 (76.4%)	469 (76.0%)
Have a lot of choices in the industry	1166 (63.9%)**	521 (73.7%)	466 (75.5%)
Usually work alone	1101 (60.4%)**	57 (8.1%)	47 (7.6%)
Make a difference in people's lives	1067 (58.5%)**	546 (77.2%)	466 (75.5%)
Mainly work on machines and computers	933 (51.2%)**	264 (37.3%)	265 (42.9%)
Work on trains	831 (45.6%)	301 (42.6%)	295 (47.8%)
Invent things	680 (37.3%)**	552 (78.1%)	469 (76.0%)
Travel around the world	419 (23.0%)**	276 (39.0%)	223 (36.1%)
Use English and writing skills	333 (18.3%)**	206 (29.1%)	165 (26.7%)
Only work in a laboratory	268 (14.7%)**	40 (5.7%)	40 (6.5%)
Design and build solutions to problems	216 (11.9%)**	620 (87.7%)	549 (89.0%)
I don't know what engineers do	147 (8.1%)**	20 (2.8%)	22 (3.6%)
Generally just work on one thing	117 (6.4%)	47 (6.6%)	46 (7.5%)
Mainly work on things that have nothing to do with me	97 (5.3%)	24 (3.4%)	31 (5.0%)

* Significant at p < .05 level.
** Significant at p < .01 level.

For many of these job roles, we found that students who were familiar with EYL were significantly *more likely* to associate the following job roles with engineers than students who were unfamiliar with EYL:

- Think creatively (Year 2 $\chi^2_{(df=1)} = 51.845$, p = 0.000; Year 3 $\chi^2_{(df=1)} = 5.134$, p = 0.023)
- Make a difference in people's lives (Year 2 $\chi^2_{(df=1)} = 76.014$, p = 0.000; Year 3 $\chi^2_{(df=1)} = 8.950$, p = 0.003)
- Have a lot of choices in the industry (Year 2 $\chi^2_{(df=1)} = 21.127$, p = 0.000; Year 3 $\chi^2_{(df=1)} = 4.107$, p = 0.043)
- Design and build solutions to problems (Year 2 $\chi^2_{(df=1)} = 1320.438$, p = 0.000)
- Use their math and science skills (Year 2 $\chi^2_{(df=1)} = 10.621$, p = 0.001)
- Invent things (Year 2 $\chi^2_{(df=1)} = 336.998$, p = 0.000)
- Sometimes work with other professions (Year 2 $\chi^2_{(df=1)} = 9.218$, p = 0.000)
- Work as part of a team (Year 2 $\chi^2_{(df=1)} = 20.000$, p = 0.000)
- Use English and writing skills (Year 2 $\chi^2_{(df=1)} = 35.180$, p = 0.000)
- Travel around the world (Year 3 $\chi^2_{(df=1)} = 8.244$, p = 0.004)

Interest in Engineering Jobs

We asked students to describe their level of interest in a variety of different engineering jobs, without explicitly indicating to the respondents that the jobs were actually ones performed by engineers.

Roughly half of the students in across all three years were "very interested" or "interested" in designing life saving medical devices for patients with heart disease and in teaching communities to make their drinking water safe, both of which are engineering-related jobs. In Year 2, we found that students who were familiar with EYL were significantly *more likely* to report that they would be interested in helping to build schools that can withstand earthquakes ($t_{(df=324.693)}$ = 3.095, p = 0.002) and inventing a more powerful superglue ($t_{(df=314.115)}$ = 3.022, p = 0.003) than students who were unfamiliar with EYL. In Year 3, we found that students who were familiar with EYL were more likely to report that they would want to build schools that can withstand earthquakes ($t_{(df=615)}$ = 2.631, p = 0.009), teach communities to make their drinking water safe ($t_{(df=187.012)}$ = 2.768, p = 0.006), develop user-friendly blogging software ($t_{(df=615)}$ = 2.304, p = 0.021), and invent a more powerful superglue ($t_{(df=615)}$ = 2.305, p = 0.021) than students who were unfamiliar with EYL.

Table 11:

Jobs that Interest Students

Jobs	Year 1 Frequency & Percentage (N = 1,824)	Year 2 Frequency & Percentage (N = 707)	Year 3 Frequency & Percentage (N = 617)
Designing life saving medical devices for patients with heart disease	933 (51.2%)	395 (55.9%)*	300 (48.6%)
Teaching communities to make their drinking water safe	784 (42.9%)**	384 (54.3%)	317 (51.4%)
Creating special effects for the movies	588 (32.2%)	248 (35.1%)*	203 (32.9%)
Helping build schools that can withstand the effects of earthquakes	503 (27.6%)**	347 (49.1%)	276 (44.7%)
Developing user-friendly blogging software	278 (15.2%)**	194 (27.4%)**	143 (23.2%)
Inventing a more powerful superglue	269 (14.7%)**	240 (33.9%)**	147 (23.8%)

* Significant at p < .05 level.
** Significant at p < .01 level.

Experience with Engineer Your Life

Familiarity with EYL

In Year 2, after the launch of the Engineer Your Life website, we added several questions to the student survey about their knowledge of, and experience with, the website and other EYL resources. This section summarizes our findings from Years 2 and 3.

In Year 2, 165 (26.1%) of the students reported that they had heard about EYL before they received an invitation to participate in the survey. In Year 3, 114 (18.5%) of the students

reported the same. Those who had heard about EYL reported hearing about it from various sources.

Table 12:

Where Students Heard about EYL

Source	Year 2 Frequency & Percentage (N = 165)	Year 3 Frequency & Percentage (N = 114)
Career fair	69 (41.8%)	18 (15.8%)
Package in the mail	42 (25.5%)	11 (9.6%)
I found the EYL website through search engine	39 (23.6%)	36 (31.6%)
Career counselor	21 (12.7%)	6 (5.3%)
Educator	17 (10.3%)	31 (27.2%)
Friend or family member	10 (6.1%)	15 (13.2%)
Poster	9 (5.5%)	10 (8.8%)
Facebook	8 (4.8%)	13 (11.4%)
Other website	5 (3.0%)	7 (6.1%)

Note: Percentages add up to greater than 100% because respondents could choose more than one source.

Other sources of information about EYL included:

- Society for Women in Engineering
- http://www.discoverengineering.org/
- EWeek website
- https://myroad.collegeboard.com
- Prep HQ
- http://www.renzulli.com
- http://www.collegeweeklive.com
- http://www.engineergirl.org
- http://www.marketwire.com
- FIRST Robotics
- National Academy of Engineering
- Visiting college campuses or website (Texas A&M, Cornell, Cooper Union, Colorado University, University of Texas)
- "Wow! That's Engineering"

As reported earlier, students who reported that they were familiar with EYL were significantly *more likely* to report that they wanted to be engineers (78.8% in Year 2 and 71.9% in Year 3) than students in Year 2 who were unfamiliar with EYL (57.3% in Year 2 and 43.9% in Year 3) (Year 2 $\chi^2_{(df=1)} = 23.211$, $p = 0.000$; Year 3 $\chi^2_{(df=1)} = 28.031$, $p = 0.000$). Note that the difference from Year 2 to Year 3 was not statistically significant for students who were familiar with EYL.

That is, the decrease from 78.8% to 71.9% is not a statistically significant drop, indicating that the level of interest in engineering among students familiar with EYL was sustained over time. Whereas, the difference from Year 2 to 3 for students who were unfamiliar with EYL was significant. Students who were unfamiliar with EYL were significantly less interested in engineering this year than last ($\chi^2_{(df=1)} = 16.740$, $p = 0.000$).

In Year 2, we found that students who were familiar with EYL were *more likely* than students who were unfamiliar with EYL to believe that the following skills were important to engineers:

- Imagination and creativity ($\chi^2_{(df=2)} = 6.755$, $p = 0.034$)
- Good people skills ($\chi^2_{(df=2)} = 7.424$, $p = 0.024$)
- Good writing skills ($\chi^2_{(df=2)} = 10.274$, $p = 0.006$)
- Good public speaking skills ($\chi^2_{(df=2)} = 10.120$, $p = 0.006$)

In Year 3, we found that students who were familiar with EYL were *more likely* than students who were unfamiliar with EYL to believe that the following skills were important to engineers:

- Imagination and creativity ($\chi^2_{(df=1)} = 7.886$, $p = 0.005$)
- Good people skills ($\chi^2_{(df=1)} = 7.424$, $p = 0.024$)
- Good public speaking skills ($\chi^2_{(df=1)} = 6.418$, $p = 0.011$)

We found that students who were familiar with EYL were significantly *more likely* to associate the following job roles with engineers than students who were unfamiliar with EYL:

- Think creatively (Year 2 $\chi^2_{(df=1)} = 51.845$, $p = 0.000$; Year 3 $\chi^2_{(df=1)} = 5.134$, $p = 0.023$)
- Make a difference in people's lives (Year 2 $\chi^2_{(df=1)} = 76.014$, $p = 0.000$; Year 3 $\chi^2_{(df=1)} = 8.950$, $p = 0.003$)
- Have a lot of choices in the industry (Year 2 $\chi^2_{(df=1)} = 21.127$, $p = 0.000$; Year 3 $\chi^2_{(df=1)} = 4.107$, $p = 0.043$)
- Design and build solutions to problems (Year 2 $\chi^2_{(df=1)} = 1320.438$, $p = 0.000$)
- Use their math and science skills (Year 2 $\chi^2_{(df=1)} = 10.621$, $p = 0.001$)
- Invent things (Year 2 $\chi^2_{(df=1)} = 336.998$, $p = 0.000$)
- Sometimes work with other professions (Year 2 $\chi^2_{(df=1)} = 9.218$, $p = 0.000$)
- Work as part of a team (Year 2 $\chi^2_{(df=1)} = 20.000$, $p = 0.000$)
- Use English and writing skills (Year 2 $\chi^2_{(df=1)} = 35.180$, $p = 0.000$)
- Travel around the world (Year 3 $\chi^2_{(df=1)} = 8.244$, $p = 0.004$)

In Year 2, we found that students who were familiar with EYL were significantly *more likely* to report that they would be interested in helping to build schools that can withstand earthquakes ($t_{(df=324.693)} = 3.095$, $p = 0.002$) and inventing a more powerful superglue ($t_{(df=314.115)} = 3.022$, $p = 0.003$) than students who were unfamiliar with EYL. In Year 3, we found that students who were familiar with EYL were more likely to report that they would want to build schools that can withstand earthquakes ($t_{(df=615)} = 2.631$, $p = 0.009$), teach communities to make their drinking water safe ($t_{(df=187.012)} = 2.768$, $p = 0.006$), develop user-friendly blogging software ($t_{(df=615)} =$

2.304, p = 0.021), and invent a more powerful superglue ($t_{(df=615)}$ = 2.305, p = 0.021) than students who were unfamiliar with EYL.

Website

We asked respondents to report on their favorite aspects of the EYL website. 107 students in Year 2 and 36 students in Year 3 responded to this question. The following is a list of their favorite aspects of the site:

Table 13:

Students' Favorite Areas of the EYL Website

Areas	Year 2 Frequency & Percentage (N = 107)	Year 3 Frequency & Percentage (N = 36)
Learning about the different types of engineering jobs (including salary information and links)	46 (43.0%)	12 (33.3%)
Reading the stories about women engineers	17 (15.9%)	9 (25.0%)
Getting information about how to become an engineer (Preparing for college, Taking a Test Drive, Looking at Programs, Scholarship Information, etc.)	15 (14.0%)	5 (14.9%)
Watching videos	14 (13.1%)	3 (9.6%)
Top Ten Reasons to become an engineer	11 (10.3%)	6 (17.0%)
Don't know	4 (3.7%)	1 (3.2%)

Most of the students who viewed the website (95.3% in Year 2 and 91.7% in Year 3) indicated that the website helped them learn about engineering. Many students also indicated that the website made them more interested in engineering as a career (87.9% in Year 2 and 77.8% in Year 3) and inspired them to take an engineering class in college (75.5% in Year 2 and 77.8% in Year 3).

In addition, many students indicated that the website helped them understand what they should do if they wanted to become engineers (79.2% in Year 2 and 75.0% in Year 3). Most reported that they would recommend the website to their friends (91.5% in Year 2 and 100% in Year 3).

Engineer Findings

Participant Characteristics

The following table summarizes the engineers' demographic information. In Year 1, our sample contained more men than women. In Year 2 and 3, the samples contained more women than men. Our sample included engineers with a range of experience, from current engineering students, to engineers with over 15 years of experience. The Year 1 sample reported the most experience, followed by the Year 3 sample, then the Year 2 sample ($F_{(2, 1182)} = 19.550$, $p = 0.000$). There were no significant differences in educational degrees from year to year.

Table 14:

Engineer Demographic Data

	Year 1 Frequency & Percentage (N = 401)	Year 2 Frequency & Percentage (N = 411)	Year 3 Frequency & Percentage (N = 375)
Gender			
Female	180 (44.9%)	320 (77.9%)	227 (60.5%)
Male	216 (53.9%)	90 (21.9%)	148 (39.5%)
Missing	5 (1.2%)	1 (0.2%)	0 (0.0%)
Education / Certification			
High school diploma	10 (2.5%)	16 (3.9%)	21 (5.6%)
Bachelor's degree	197 (49.1%)	198 (48.2%)	183 (48.8%)
Master's degree	156 (38.9%)	159 (38.7%)	134 (35.7%)
Ph.D.	30 (7.5%)	32 (7.8%)	34 (9.1%)
Other (grad certificate in business administration, AAS, some college, Associate's degree, Harvard Small Business Owner training, MD, some Master's work)	12 (3.0%)	20 (4.9%)	0 (0.0%)
Missing	3 (0.7%)	6 (1.5%)	3 (0.8%)
Years in the Engineering Industry			
Current student	16 (4.0%)	37 (9.0%)	29 (7.7%)
0-3	27 (6.7%)	57 (13.9%)	47 (12.5%)
3-5	19 (4.7%)	49 (11.9%)	30 (8.0%)
5-10	72 (18.0%)	64 (15.6%)	43 (11.5%)
10-15	49 (12.2%)	61 (14.8%)	52 (13.9%)
Greater than 15	216 (53.9%)	143 (34.8%)	174 (46.4%)
Missing	2 (0.5%)	0 (0.0%)	0 (0.0%)

Best Things About Life as an Engineer

We asked the engineers to consider the best things about their lives as engineers. The survey included multiple options among which the respondents were asked to choose their top three. Respondents chose "designing solutions to problems" as their top choice (69.1% in Year 1, 60.3% in Year 2, and 53.7% in Year 3); all of the other answers were chosen by fewer than half (50%) of the respondents. The table below summarizes respondents' choices.

Table 15:

Three Best Things about Life as an Engineer

Three Best Things about Life as an Engineer	Year 1 Frequency & Percent (N = 401)	Year 2 Frequency & Percent (N = 411)	Year 2 Frequency & Percent (N = 375)
Designing solutions to problems	277 (69.1%)**	248 (60.3%)	201 (53.7%)
Working in a challenging but rewarding industry	171 (42.6%)	161 (39.2%)	113 (30.2%)**
Using creative skills	148 (36.9%)	148 (36.0%)	111 (29.6%)
Earning a high salary and benefits	126 (31.4%)	133 (32.4%)	106 (28.3%)
Having the opportunity to make a social or economic impact	122 (30.4%)	103 (25.1%)	72 (19.2%)**
Having a flexible schedule	97 (24.2%)**	82 (20.0%)	58 (15.5%)
Interacting with engineering colleagues	94 (23.4%)**	61 (14.8%)	32 (8.5%)
Using math and science skills	86 (21.4%)	79 (19.2%)	65 (17.3%)
Having the opportunity to make an impact on technology or medicine	76 (19.0%)**	57 (13.9%)	41 (10.9%)
Interacting with people from other industries	59 (14.7%)	64 (15.6%)	25 (6.7%)**
Traveling on business	31 (7.7%)	25 (6.1%)	15 (4.0%)
Using humanities and social science skills	14 (3.5%)	12 (2.9%)	9 (2.4%)
Teaching engineering students[a]	3 (0.7%)	0 (0.0%)	25 (6.7%)
Overall job satisfaction and seeing the results of my work[a]	3 (0.7%)	0 (0.0%)	77 (20.5%)
Always learning and having variety of opportunities for learning at work[a]	0 (0.0%)	4 (1.0%)	151 (40.3%)
Other	5 (1.2%)	6 (1.5%)	4 (1.1%)

Note: Percentages add up to >100% because respondents were each asked to pick three options.
[a] These options were added to the Year 3 survey, but were extracted from respondents' "other" responses in Year 1 and 2. In other words, these options were not included in the Year 1 and Year 2 surveys. So, the large difference should not be interpreted to mean that there was a significantly greater level of interest in Year 3 (and we have not run a statistical analysis for these options).
** Significant at $p < .01$ level.

"Designing solutions to problems" was the most frequently chosen option across all three years. However, significantly more engineers chose the option in Year 1 versus Years 2 and 3 ($\chi^2_{(df=2)} = 19.367$, $p = 0.000$). Engineers in Year 1 were also significantly more likely than engineers in Years 2 and 3 to pick the options "having a flexible schedule" ($\chi^2_{(df=2)} = 9.122$, $p = 0.010$), "interacting with engineering colleagues" ($\chi^2_{(df=2)} = 32.690$, $p = 0.000$), and "having the opportunity to make an impact on technology or medicine" ($\chi^2_{(df=2)} = 10.192$, $p = 0.006$).

Engineers in Year 3 were significantly less likely than engineers in Year 1 and 2 to choose the following options as their top choices: "working in a challenging but rewarding industry" ($\chi^2_{(df=2)} = 13.485$, $p = 0.000$), "having the opportunity to make a social or economic impact" ($\chi^2_{(df=2)} =$

12.869, p = 0.002), and "interacting with people from other industries" ($\chi^2_{(df=2)} = 16.930$, p = 0.000).

Upon further investigation, analyses revealed significant differences between males and females. For example:

- In Year 1, females were more likely than males to choose "designing solutions to problems" as one of their top three responses (Year 1 $\chi^2_{(df=1)} = 10.092$, p = 0.001). In Years 2 and 3, males were more likely to choose this (Year 2 $\chi^2_{(df=1)} = 10.295$, p = 0.001; Year 3 $\chi^2_{(df=1)} = 18.942$, p = 0.000).
- In Year 1, females were more likely than males to cite "using creative skills" as a highlight of their job as an engineer (Year 1 $\chi^2_{(df=1)} = 10.667$, p = 0.001). In Year 2, males were more likely (Year 2 $\chi^2_{(df=1)} = 6.480$, p = 0.011). In Year 3, there was no difference between males and females.
- In Year 1 only, females were more likely than males to report "interacting with engineering colleagues" as a positive aspect of their job (Year 1 $\chi^2_{(df=1)} = 5.529$, p = 0.011). We did not observe this finding in Year 2 or in Year 3.
- In Year 1, males were more likely than females to report that "earning a high salary and benefits" was one of the most enticing aspects of being an engineer ($\chi^2_{(df=1)} = 6.825$, p = 0.013). In Year 2, females were more likely to report this ($\chi^2_{(df=1)} = 10.469$, p = 0.001). We did not observe this finding in Year 3.
- In Year 1 only, males were more likely than females to include "having a flexible schedule" as one of their top three responses ($\chi^2_{(df=1)} = 7.622$, p = 0.006).
- In Year 3 only, females were more likely than males to choose "having the ability to make a social or economic impact" as one of their top choices ($\chi^2_{(df=1)} = 8.409$, p = 0.004).

Choosing to Pursue an Engineering Career

We asked the engineers to answer a series of questions regarding when they decided to become an engineer and their recommendations for when students should be encouraged to start pursuing engineering. Across all three years, the most common response was that they decided to become engineers in high school (48.5% in Year 1, 48.4% in Year 2, and 37.3% in Year 3).

Approximately one third of the respondents reported that they decided to pursue engineering in college or later (31.3% in Year 1, 29.9% in Year 2, and 31.5% in Year 3). In Year 1 and 2, less than one-quarter of the engineers reported that they decided to become an engineer in middle school or younger (20.3% in Year 1, 21.7% in Year 2); 31.5% of engineers in Year 3 reported that they had decided before college to become an engineer.

However, although most respondents reportedly decided to become an engineer in high school, they reported that current students should be encouraged to pursue engineering at a young age. The majority of respondents reported that current students should be encouraged to pursue a career in engineering in junior high (42.9% in Year 1, 40.6% in Year 2, and 45.3% in Year 3) or in elementary school (35.3% in Year 1, 39.2% in Year 2, and 28.8% in Year 3).

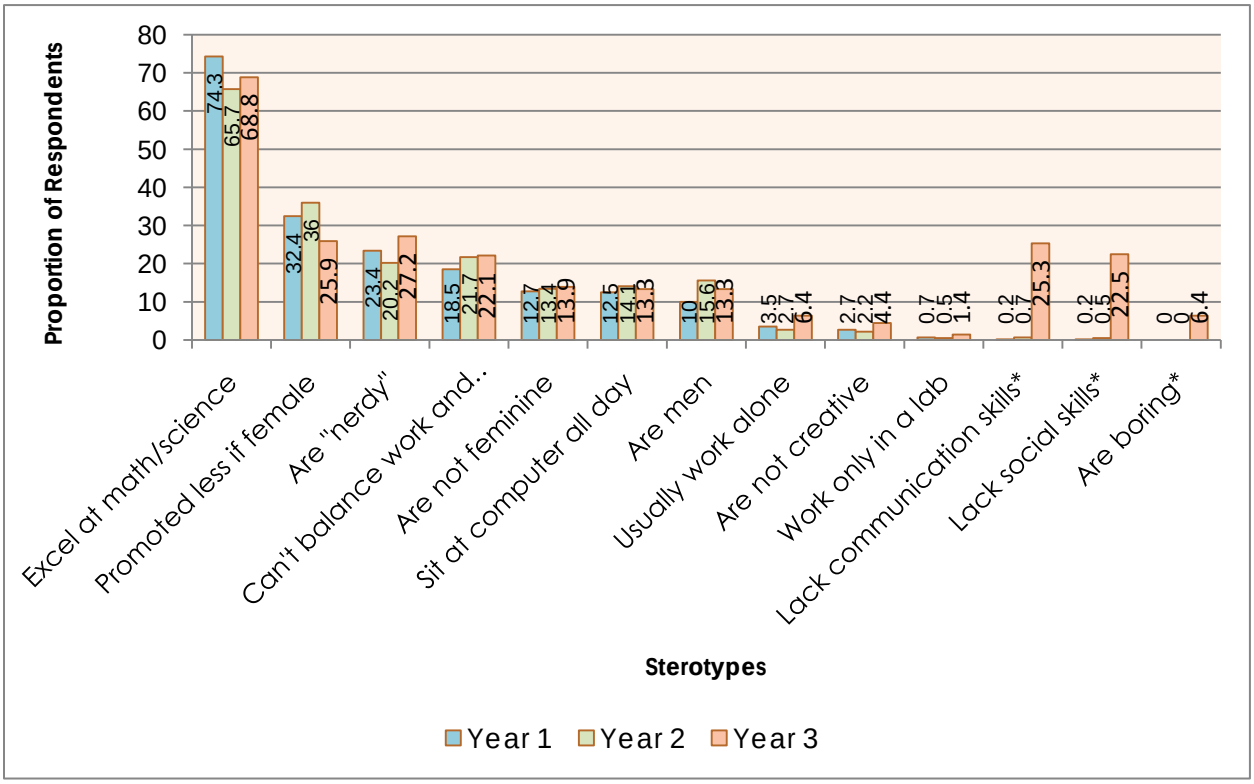
Engineer Role Models and Stereotypes

Role Models

We asked the engineers whether they had any male or female engineers as role models when they were in school or starting their career. Very few respondents reported having a female role engineer as a role model (14.5% in Year 1, 21.9% in Year 2, 17.6% in Year 3). Meanwhile, 66% of respondents in Years 1 and 2 and 63% of respondents in Year 3 reported that they had a male engineer as a role model.

Stereotypes

We presented the respondents with a set of common stereotypes about engineers. The engineers identified those stereotypes that they believed to be true about engineers. Across all three years, the most common stereotypes that engineers perceived to be true included: (1) engineers must excel at math and science, (2) engineers are promoted less if they are female, and (3) engineers are "nerdy."



Note: Percentages add up to >100% because respondents were able to choose more than one answer.
* These options were not present in the Year 1 and 2 surveys. Participants mentioned them in their "other" responses.

Figure 2. Stereotypes that Engineers Perceive to be True

Barriers to Women Entering Engineering

We asked the engineer respondents to identify some barriers to women entering into the field of engineering.

Across all three years, most respondents (85% in Year 1 and 2 and 82% in Year 3) reported that there were barriers that prevented women from entering into engineering. Engineers who were unfamiliar with EYL were significantly less likely to agree that there were barriers preventing women from entering the field (Year 2 $\chi^2_{(df=1)} = 8.375$, $p = 0.004$; Year 3 $\chi^2_{(df=1)} = 6.759$, $p = 0.009$).

The most commonly reported barrier was young women's lack of familiarity with the engineering industry (83% of respondents in Years 1 and 2, 65% in Year 3).

Other key barriers included: a lack of visible role models, the perception of having to work in a male-dominated environment and being the "lone female," and the masculine image of engineering.

Engineers were less likely to perceive that the following factors were barriers to women becoming engineers: a lack of flexibility, the need to excel in math and science, and lack of teamwork—often having to work alone.

Table 16:

Barriers that Prevent Women from Becoming Engineers

Barriers	Year 1 Frequency & Percentage	Year 2 Frequency & Percentage	Year 3 Frequency & Percentage
Young women are not familiar with engineering job roles	328 (82.8%)	341 (83.0%)	243 (65.1%)
A lack of visible role models	291 (72.6%)	290 (70.6%)	226 (60.6%)
Working in a male dominated environment; being the lone female	227 (56.6%)	222 (54.0%)	185 (49.3%)
The "masculine" image of engineering	211 (52.6%)	220 (53.5%)	180 (48.3%)
Workplace culture and practices	157 (39.2%)	161 (39.2%)	131 (35.1%)
College counselors aren't doing enough to encourage women to enter the industry	142 (35.4%)	172 (41.8%)	106 (28.4%)
Employers aren't doing enough to encourage women to enter the industry	133 (33.2%)	120 (29.2%)	58 (15.5%)
Engineering isn't a female friendly profession	123 (30.7%)	126 (30.7%)	48 (12.9%)
Women have not naturally entered the industry yet	101 (25.2%)	91 (22.1%)	39 (10.5%)
A lack of flexibility	58 (14.5%)	73 (17.8%)	48 (12.9%)
Engineers need to excel at math and science	44 (11.0%)	38 (9.2%)	49 (13.1%)
Lack of teamwork; working alone often	20 (5.0%)	20 (4.9%)	14 (3.8%)

Note: Percentages add up to >100% because respondents were able to choose more than one answer.

Engineers who were familiar with EYL were significantly more likely than engineers who were unfamiliar with EYL to report that the following factors were barriers:

- Young women are not familiar with engineering job roles (Year 2 $\chi^2_{(df=1)} = 4.774$, p = 0.029; Year 3 $\chi^2_{(df=1)} = 10.211$, p = 0.001).
- A lack of visible role models (Year 2 $\chi^2_{(df=1)} = 10.460$, p = 0.001).
- College counselors aren't doing enough to encourage women to enter the industry (Year 3 $\chi^2_{(df=1)} = 19.623$, p = 0.000).

Gender Equality in Engineering

We asked the engineers to respond to the following question:

"In your opinion, are females accepted as equals by their peers in the field of engineering?"

In Year 1, 63% of respondents answered yes, females are accepted as equals by their peers in the field of engineering. In Year 2, only 57.7% responded affirmatively and in Year 3, only 58.4% did. These differences were not statistically significant. We also explored the question of whether engineers who were familiar with EYL would have a different opinion than engineers who were unfamiliar with EYL. But, we found no differences between them.

Although more than half of respondents reported that females are accepted as equals by their engineering colleagues, many respondents cited perceived gender inequality as a barrier to women entering the engineering industry. For example:

- Thirty-one percent (31%) of respondents in Years 1 and 2 and 13% of those in Year 3 indicated that there were not more women engineers because engineering is not a female-friendly profession.
- Roughly half of the respondents (53.7% in Year 1, 53.5% in Year 2, 48.3% in Year 3) reported that the "masculine" image of engineering was a barrier to women entering into engineering as a career.
- Roughly half of the respondents (57.9% in Year 1, 54.0% in Year 2, 49.3% in Year 3) reported that "working in a male-dominated environment/being the lone female" was an entry barrier for women.

Interestingly, these findings were significant when controlling for gender. In Year 1, females were more likely than males to report that women were accepted as equals in the field ($\chi^2_{(df=1)} = 17.266$, p = .000). 74.4% of females indicated that women were considered equal, while only 53.7% of males stated that women were considered equal. In Years 2 and 3, we found the opposite: 77.8% of males in Year 2 and 74.3% of males in Year 3 reported that women were accepted as equals and only 52.2% of females in Year 2 and 48% of females in Year 3 reported the same (Year 2 $\chi^2_{(df=1)} = 17.825$, p = 0.000; Year 3 $\chi^2_{(df=1)} = 24.449$, p = 0.000).

Experience with Students/Career Counseling

After gathering information on their experiences in the engineering industry, we asked the engineers to respond to a series of questions regarding their interactions with students who may be interested in pursuing engineering.

Student Participation in Mentoring and Career Counseling

Many engineers reported that they had not been asked to mentor students or offer career advice (33.9% in Year 1; 31.1% in Year 2; 26.1% in Year 3). However, of the engineers who had worked with students, most of the students were in high school or college. The following table summarizes the students' grade level and the percentage of engineers who have worked with students at each level.

Table 17:

Grade Levels for which Engineers have been Mentors

Student Grade Level	Year 1 Frequency & Percentage (N = 246)	Year 2 Frequency & Percentage (N = 283)	Year 3 Frequency & Percentage (N = 277)
High school students	62 (25.2%)	80 (23.3%)	75 (27.1%)
College students	85 (34.6%)	74 (26.1%)	60 (21.7%)
Both high school and college students	99 (40.2%)	129 (45.6%)	142 (51.3%)

Engineer Participation in Science and Engineering Activities with Students

We asked the engineers to respond to a series of questions regarding their participation in various science and engineering activities with students and their intentions to participate in the same activities in the future. Each of the three years, engineers reported that they were most involved in career fairs, career exploration days, mentoring programs, and guest lectures at high schools. In Year 1, engineers were significantly less likely to report they were involved with career fairs, outreach programs, and engineering summer camps than respondents in Year 2 and 3.

Engineers who were familiar with EYL were significantly more likely than engineers who were unfamiliar with EYL to report participating in the following activities:

- Guest lectures at high schools (Year 2 $\chi^2_{(df=1)} = 8.951$, $p = 0.003$; Year 3 $\chi^2_{(df=1)} = 37.058$, $p = 0.000$).
- Career fairs (Year 2 $\chi^2_{(df=1)} = 6.638$, $p = 0.001$; Year 2 $\chi^2_{(df=1)} = 18.664$, $p = 0.000$).
- Engineering summer camps (Year 2 $\chi^2_{(df=1)} = 4.874$, $p = 0.027$; Year 3 $\chi^2_{(df=1)} = 32.199$, $p = 0.000$).
- Outreach programs (Year 2 $\chi^2_{(df=1)} = 8.351$, $p = 0.004$; Year 3 $\chi^2_{(df=1)} = 73.484$, $p = 0.000$).
- Mentoring programs (Year 3 $\chi^2_{(df=1)} = 16.684$, $p = 0.000$).
- Career exploration days (Year 3 $\chi^2_{(df=1)} = 24.471$, $p = 0.000$).
- Engineering Week (Year 3 $\chi^2_{(df=1)} = 28.913$, $p = 0.000$).[17]
- School events (Year 3 $\chi^2_{(df=1)} = 16.107$, $p = 0.000$). [18]

[17] Included as a response option in Year 3 only.
[18] Included as a response option in Year 3 only.

- Girl Scouts (Year 3 $\chi^2_{(df=1)} = 29.802$, $p = 0.000$). [19]

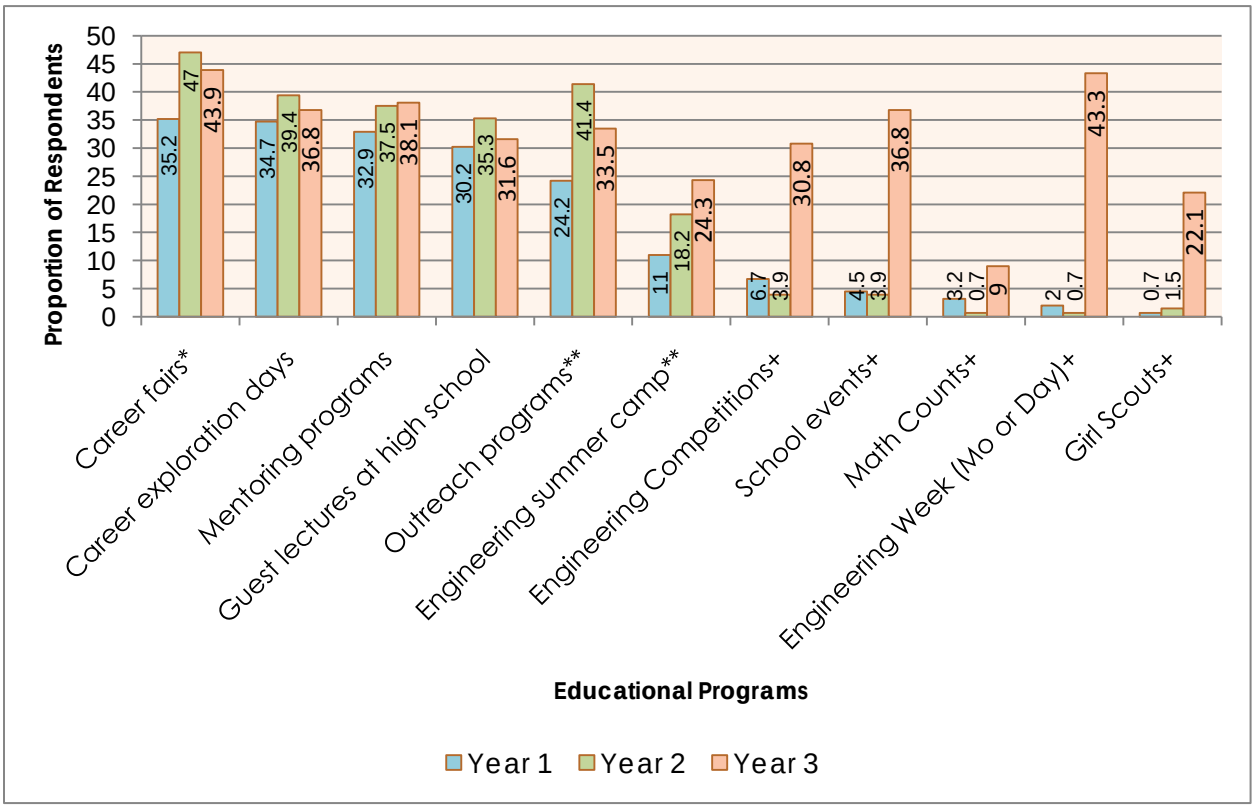


Figure 3. Engineers' self-reported participation in activities with students.

Note: Percentages add up to >100% because respondents were able to choose more than one answer.
+ These options were not present in the Year 1 and 2 surveys. Participants mentioned them in their "other" responses. The options were added to Year 3.
* Difference is significant at the $p < .05$ level.
** Difference is significant at the $p < .01$ level.

As the figure below demonstrates, the engineers' reportedly planned to increase their participation in mentoring programs, guest lectures at high schools, career exploration days, career fairs, and outreach programs.

[19] Included as a response option in Year 3 only.

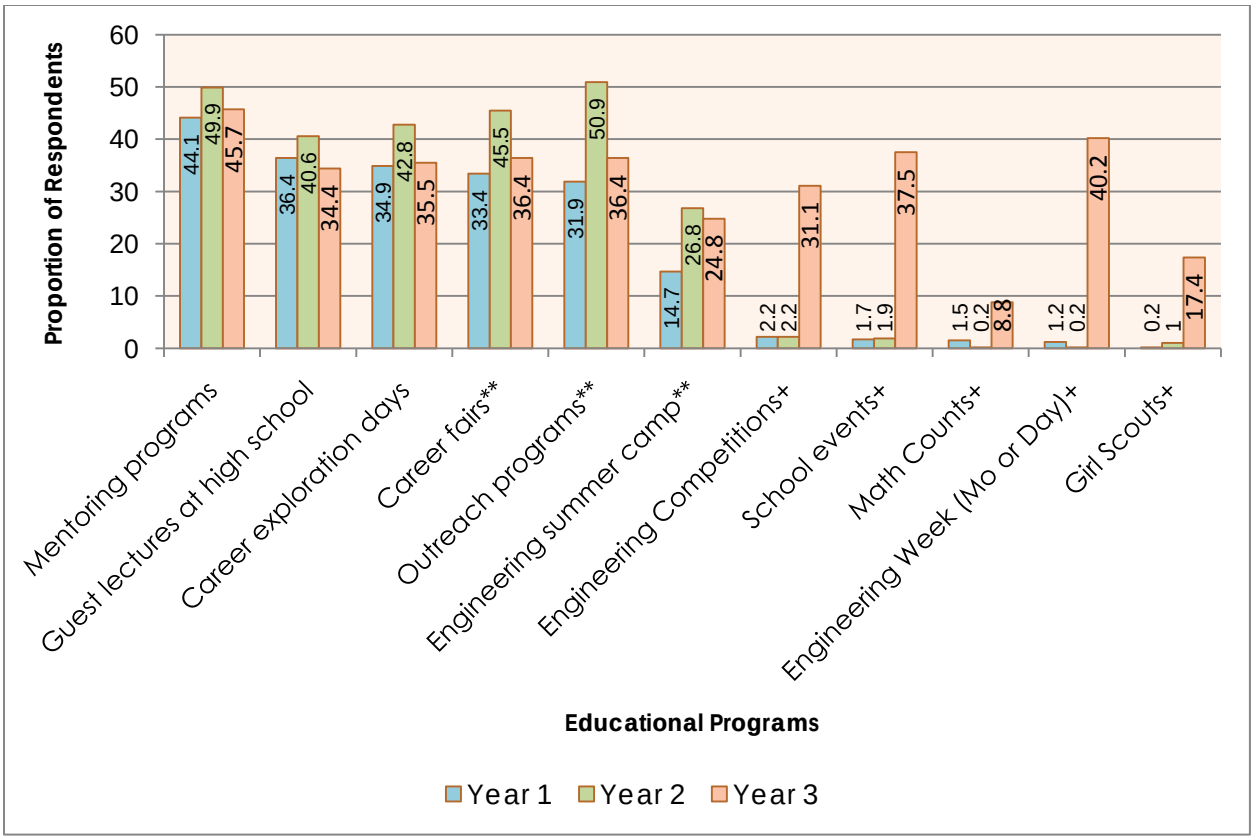


Figure 4. Engineers' self-reported intended future participation in activities with students.

Note: Percentages add up to >100% because respondents were able to choose more than one answer.
+ These options were not present in the Year 1 and 2 surveys. Participants mentioned them in their "other" responses. The options were added to Year 3.
** Difference is significant at the $p < .01$ level.

What Students Should Know about Engineering

Although the engineers reportedly did not have an abundance of experience mentoring or counseling students, they suggested many factors to emphasize when speaking with female students.

Ranking the Importance of Engineering Characteristics to Discuss with Female Students

We asked the engineers to imagine that they were speaking to a group of female students about their life as an engineer and to rank the importance of several factors that may or may not be important to discuss with the students.

Across all three years, the respondents cited the following top two factors as the most important to discuss with students:

1. Examples of the projects engineers work on
2. The skills needed to become an engineer
3. Different engineering fields (e.g., civil, environmental)

4. Opportunities to make a social or economic impact
5. The day-to-day responsibilities involved in working as an engineer

In contrast, Year 1 and Year 2 respondents cited the following five factors as the least important to discuss with students:

1. Salary and benefits
2. Schedule and hours, including flexibility of time
3. Emphasizing that students must excel at math and science
4. Opportunities for travel
5. The importance of a diverse workforce

The following tables summarize the proportion of respondents who ranked each factor as their top two or bottom two choices.

Table 18: Most and Least Important Factors to Discuss with Students about Engineering

Factor	Year 1 (N = 401)				Year 2 (N = 411)				Year 3 (N = 375)			
	1st	2nd	12th	13th	1st	2nd	12th	13th	1st	2nd	12th	13th
Project examples	22%	17%	1%	1%	30%	18%	<1%	<1%	26%	18%	1%	1%
Skills needed	18%	11%	2%	1%	15%	7%	3%	2%	18%	10%	3%	1%
Different engineering fields	15%	14%	2%	1%	17%	17%	1%	<1%	16%	14%	1%	1%
Opportunities to make a social or economical impact	14%	7%	4%	2%	13%	17%	3%	3%	15%	12%	5%	2%
Responsibilities / day to day work	11%	11%	4%	2%	10%	10%	4%	3%	11%	11%	3%	3%
Educational curriculum	7%	9%	5%	2%	3%	9%	8%	3%	6%	10%	7%	3%
Opportunities to make an impact on technology or medicine	5%	11%	6%	3%	6%	10%	6%	4%	7%	13%	6%	3%
Emphasizing that students must excel at math and science	4%	6%	9%	12%	2%	2%	11%	19%	4%	4%	9%	16%
Salary and benefits	2%	2%	8%	6%	2%	4%	8%	9%	2%	2%	9%	8%
Interaction with colleagues	1%	2%	5%	4%	2%	3%	10%	6%	1%	3%	7%	6%
Schedule and hours, including flexibility of time	1%	2%	16%	9%	<1%	2%	15%	9%	1%	2%	16%	9%
Opportunities for travel	1%	2%	18%	20%	<1%	2%	17%	15%	1%	1%	18%	19%
The importance of a diverse workforce	1%	3%	13%	29%	3%	3%	10%	25%	2%	3%	12%	30%

Important Aspects of Engineering to Discuss with Female Students

After the engineer respondents ranked the factors listed in Table 17, we asked them to report on additional aspects of engineering that are important for high school girls to understand. Across all three years, the respondents chose the following six statements as the most important aspects for high school girls to know about engineering:

- Engineers make a difference in the world.
- An engineering degree offers students the freedom to choose from a variety of professions.
- Engineers need to have creative skills and imagination.
- There are many different engineering fields.
- Engineering is an exciting profession.
- Engineering takes teamwork.

The following table summarizes which aspects of engineering the respondents reported were important for high school girls to know.

Table 19:

Aspects of Engineering that Engineers Believe High School Girls Should Know

Statements	Year 1 Frequency & Percentage (N = 401)	Year 2 Frequency & Percentage (N = 411)	Year 3 Frequency & Percentage (N = 375)
Engineers make a difference in the world	301 (75.1%)	327 (79.6%)	264 (70.4%)**
An engineering degree offers students the freedom to choose from a variety of professions	297 (74.1%)	332 (80.8%)	299 (79.7%)
Engineers need to have creative skills and imagination	248 (61.8%)	256 (62.3%)	181 (48.3%)**
There are many different engineering fields	245 (61.1%)	250 (60.8%)	199 (53.1%)**
Engineering is an exciting profession	228 (56.9%)	225 (54.7%)	175 (46.7%)**
Engineering takes teamwork	201 (50.1%)	232 (56.4%)	164 (44.0%)**
Engineers' work changes day to day	163 (40.6%)	157 (38.2%)	117 (31.2%)**
Engineering is a challenging and demanding field	130 (32.4%)	125 (30.4%)	88 (23.5%)**
Math and science are extremely important to be successful in engineering	119 (29.7%)	100 (24.3%)	94 (25.1%)
Engineers work with other professions, such as doctors, architects and entrepreneurs	117 (29.2%)	116 (28.2%)	82 (21.9%)*
A lot of progress has been made in regard to gender equality in engineering	96 (23.9%)**	72 (17.5%)	53 (14.1%)
Humanities and social sciences are extremely important to be successful in engineering	60 (15.0%)	70 (17.0%)	28 (7.5%)**
Engineers have a flexible work schedule	54 (13.5%)	53 (12.9%)	33 (8.8%)
Studying to be an engineer is very difficult	39 (9.7%)	38 (9.2%)	31 (8.3%)
Engineering is a male dominated environment	22 (5.5%)	23 (5.6%)	15 (4.0%)

Statements	Year 1 Frequency & Percentage (N = 401)	Year 2 Frequency & Percentage (N = 411)	Year 3 Frequency & Percentage (N = 375)
It is difficult for engineers to balance work and family life	17 (4.2%)	10 (2.4%)	10 (2.7%)
Engineers travel a lot	15 (3.7%)	10 (2.4%)	11 (2.9%)

Note: Percentages add up to >100% because respondents were able to choose more than one answer.
* Significant at the $p < .05$ level.
** Significant at the $p < .01$ level.

Engineers who were *familiar* with EYL were significantly more likely to choose the following aspects as important:

- Engineers make a difference in the world (Year 3 $\chi^2_{(df=1)} = 5.795$, $p = 0.016$).

Engineers who were *familiar* with EYL were significantly more likely to downplay the following aspects as less important:

- Studying to be an engineer is very difficult (Year 2 $\chi^2_{(df=1)} = 4.942$, $p = 0.026$).
- Math and science are extremely important to be successful in engineering (Year 3 $\chi^2_{(df=1)} = 8.907$, $p = 0.003$).
- Engineering is a challenging and demanding field (Year 3 $\chi^2_{(df=1)} = 5.286$, $p = 0.021$).

Important Advice for Students Interested in Engineering

We asked engineers what advice they would offer either high school girls or high school boys who were interested in engineering. The most commonly reported advice was:

1. Participate in a career exploration day or shadow an engineer
2. Find a mentor who is knowledgeable
3. Consider a summer engineering job or internship
4. Research colleges that offer engineer programs
5. Enroll in a school engineering program or certain classes

The following table outlines the advice respondents would give to students. There were no significant differences with respect to the advice engineers would offer to boys versus girls, so we have only summarized the advice that engineers would give to female students below.

Table 20:

Advice that Engineers Would Offer to Female Students

Advice	Year 1 Frequency & Percent (N = 401)	Year 2 Frequency & Percent (N = 411)	Year 3 Frequency & Percent (N = 375)
Shadow an engineer	319 (83.3%)	334 (81.3%)	277 (83.1%)**
Find a mentor who is knowledgeable	296 (77.3%)	292 (71.0%)	257 (68.5%)**
Consider a summer engineering job or internship	294 (76.8%)	305 (74.2%)	279 (74.4%)
Research colleges that offer engineering programs	254 (63.3%)	268 (65.2%)	225 (60.0%)
Enroll in a school engineering program or certain classes	247 (64.5%)	259 (63.0%)	218 (58.1%)
Join engineering-related clubs or extracurricular activities	223 (58.2%)	251 (61.1%)	207 (55.2%)
Speak with an engineering student	225 (58.7%)	259 (63.0%)	219 (58.4%)
Visit engineering websites	193 (50.4%)	238 (57.9%)*	184 (49.1%)
Consider taking a wide range of classes	137 (35.8%)	145 (35.3%)	126 (33.6%)
Read books or other engineering resources	126 (32.9%)	124 (30.2%)	102 (27.2%)
Attend a college-level engineering class	86 (22.5%)	97 (23.6%)	88 (23.5%)
Consider taking various English classes	84 (21.9%)	72 (17.5%)	83 (22.1%)
Focus on math and science	7 (1.8%)	3 (0.7%)	172 (45.9%)
Keep trying and believe in yourself	4 (1.0%)	2 (0.5%)	238 (63.5%)
Work on engineering projects; practice problem-solving	2 (0.5%)	4 (1.0%)	226 (60.3%)

Note: Percentages add up to >100% because respondents were able to choose more than one answer.
* Significant at the $p < .05$ level.
** Significant at the $p < .01$ level.

In Year 3, engineers who were familiar with EYL were significantly more likely than engineers who were unfamiliar with EYL to say that they would encourage students interested in engineering to:

- Speak to an engineering student (Year 3 $\chi^2_{(df=1)} = 3.939$, $p = 0.047$).
- Research colleges that offer engineering programs (Year 3 $\chi^2_{(df=1)} = 6.179$, $p = 0.013$).
- Visit engineering websites (Year 3 $\chi^2_{(df=1)} = 17.246$, $p = 0.000$).

There were no difference in Year 2 between engineers who were familiar with EYL and those who were not.

Finally, we asked the engineer respondents to answer the following open-ended question:

"If you could tell female high school students one thing about your experiences as an engineer, what would it be?"

The most common responses to this question were:

- Engineering is rewarding
- Engineering is fun, interesting, and exciting
- There is variety in terms of career tracks and professional opportunities
- Engineering is challenging

Table 21: One Key Factor Engineers Would Share with Female High School Students

What to Tell Students	Year 1 Frequency & Percentage (N = 401)	Year 2 Frequency & Percentage (N = 411)	Year 3 Frequency & Percentage (N = 375)
Engineering is rewarding.	112 (27.9%)	122 (29.7%)	83 (22.1%)
Engineering is fun, interesting, and exciting.	74 (18.5%)	63 (15.3%)	37 (9.9%)
There is variety in terms of career tracks and professional opportunities.	56 (14.0%)	57 (13.9%)	47 (12.5%)
Engineering is challenging.	53 (13.2%)	46 (11.2%)	53 (14.1%)
Engineering requires creativity, critical thinking, and problem solving skills.	37 (9.2%)	40 (9.7%)	11 (2.9%)
There aren't as many barriers as you think; gender doesn't matter, quality of work does.	32 (8.0%)	24 (5.8%)	2 (0.8%)
It requires teamwork and the ability to communicate with many different people.	25 (6.2%)	22 (5.4%)	14 (3.7%)
Engineers are paid a good salary.	18 (4.5%)	17 (4.1%)	10 (2.7%)
Coursework and preparation is challenging.	10 (2.5%)	18 (4.4%)	5 (1.3%)
Engineering is male-dominated.	10 (2.5%)	17 (4.1%)	3 (0.8%)
Engineering expertise goes beyond math and science.	9 (2.2%)	9 (2.2%)	5 (1.3%)
You will always be learning and working through new challenges in a changing field.	8 (2.0%)	15 (3.6%)	17 (4.5%)
There are many opportunities to travel.	7 (1.7%)	9 (2.2%)	3 (0.8%)
Become an engineer because you want and like to do it.	7 (1.7%)	11 (2.7%)	8 (2.1%)
Research the field before you decide to become an engineer.	6 (1.5%)	16 (3.9%)	0 (0.0%)
Engineering offers a flexible schedule; it's good for families.	4 (1.0%)	12 (2.9%)	9 (2.4%)
Engineering is science and math-oriented.	4 (1.0%)	10 (2.4%)	6 (1.6%)
There is still gender discrimination in engineering.	3 (0.7%)	3 (0.7%)	1 (0.3%)
I wouldn't encourage women to be engineers.	1 (0.2%)	4 (1.0%)	2 (0.5%)
Engineering does NOT offer a flexible schedule; it's bad for families.	0 (0.0%)	2 (0.5%)	1 (0.3%)

Note: Percentages add up to >100% because respondents were able to choose more than one answer.

In Year 2, engineers who were familiar with EYL were significantly more likely than engineers who were unfamiliar with EYL to report that "engineering is rewarding" ($\chi^2_{(df=1)} = 4.336$, $p = 0.037$). Engineers familiar with EYL said they would tell girls:

> *Engineering has helped me discover I am smarter than I thought I was.*
>
> *It's cool to understand technology.*
>
> *It's fun to be a female who proves that girls like to solve problems and understanding how things work can also be feminine.*
>
> *Your career is what you make of it. If you want to start your own company, you can do it.*

In Year 3, engineers familiar with EYL were more likely than other engineers to report that engineering offers variety in terms of career tracks ($\chi^2_{(df=1)} = 5.518$, $p = 0.019$). Engineers familiar with EYL said they would tell girls:

> *Engineering has given me the freedom to choose how I want to make the world a better place and actually start achieving that.*
>
> *An engineering degree is only the beginning. The field is wide open and continually expanding. You can find your own place there.*
>
> *The field is diverse and the opportunities are endless with an engineering degree.*
>
> *Engineers can do anything, any career.*
>
> *Every day is different.*
>
> *I had the opportunity to change my focus about every eight years.*
>
> *There are so many different paths you can take in engineering.*

Experience with Engineer Your Life

Familiarity with EYL

In Year 2, after the launch of the Engineer Your Life website, we added several questions to the engineer survey to assess respondents' knowledge of, and experience with, the website and other EYL resources. This section summarizes our findings from Years 2 and 3.

In Year 2, 149 (36.3%) engineers reported that they had heard about EYL before receiving an invitation to participate in the survey. In Year 2, 116 (30.9%) reported they had heard of EYL. Those who had heard about EYL reported hearing about it from various sources. The most common sources of information about EYL included: Engineering Associations, the EYL website, and colleagues.

Table 22:

Where Engineers Heard about EYL

Source	Year 2 Frequency & Percentage (N = 149)	Year 3 Frequency & Percentage (N = 116)
Engineering Association	103 (69.1%)	43 (37.1%)
I found the EYL website	103 (69.1%)	50 (43.1%)
Colleague	30 (20.1%)	29 (25.0%)
Other	22 (14.8%)	9 (7.8%)
Package in the mail	7 (4.7%)	16 (13.8%)
Journals or magazines	7 (4.7%)	0 (0.0%)
Engineering Week website and National Engineers Week	6 (4.0%)	24 (20.7%)
Friend or family member	6 (4.0%)	3 (2.6%)
Employer	5 (3.4%)	10 (8.6%)
Missing	1 (0.7%)	0 (0.0%)

Note: Percentages add up to greater than 100% because respondents could choose more than one source.

As described earlier, engineers who were familiar with EYL were significantly more likely than engineers who were unfamiliar with EYL to agree that there were barriers preventing women from entering the field (Year 2 $\chi^2_{(df=1)} = 8.375$, $p = 0.004$; Year 3 $\chi^2_{(df=1)} = 6.759$, $p = 0.009$).

Engineers who were familiar with EYL were significantly more likely than engineers who were unfamiliar with EYL to report that the following factors were barriers:

- Young women are not familiar with engineering job roles (Year 2 $\chi^2_{(df=1)} = 4.774$, $p = 0.029$; Year 3 $\chi^2_{(df=1)} = 10.211$, $p = 0.001$).
- A lack of visible role models (Year 2 $\chi^2_{(df=1)} = 10.460$, $p = 0.001$).
- College counselors aren't doing enough to encourage women to enter the industry (Year 3 $\chi^2_{(df=1)} = 19.623$, $p = 0.000$).

Engineers who were familiar with EYL were significantly more likely than engineers who were unfamiliar with EYL to report participating in the following activities:

- Guest lectures at high schools (Year 2 $\chi^2_{(df=1)} = 8.951$, $p = 0.003$; Year 3 $\chi^2_{(df=1)} = 37.058$, $p = 0.000$).
- Career fairs (Year 2 $\chi^2_{(df=1)} = 6.638$, $p = 0.001$; Year 3 $\chi^2_{(df=1)} = 18.664$, $p = 0.000$).
- Engineering summer camps (Year 2 $\chi^2_{(df=1)} = 4.874$, $p = 0.027$; Year 3 $\chi^2_{(df=1)} = 32.199$, $p = 0.000$).

- Outreach programs (Year 2 $\chi^2_{(df=1)} = 8.351$, p = 0.004; Year 3 $\chi^2_{(df=1)} = 73.484$, p = 0.000).
- Mentoring programs (Year 3 $\chi^2_{(df=1)} = 16.684$, p = 0.000).
- Career exploration days (Year 3 $\chi^2_{(df=1)} = 24.471$, p = 0.000).
- Engineering Week (Year 3 $\chi^2_{(df=1)} = 28.913$, p = 0.000).[20]
- School events (Year 3 $\chi^2_{(df=1)} = 16.107$, p = 0.000). [21]
- Girl Scouts (Year 3 $\chi^2_{(df=1)} = 29.802$, p = 0.000). [22]

Engineers who were *familiar* with EYL were significantly more likely to choose the following aspects of their careers as important:

- Engineers make a difference in the world (Year 3 $\chi^2_{(df=1)} = 5.795$, p = 0.016).

Engineers who were *familiar* with EYL were significantly more likely to downplay the following career aspects as less important:

- Studying to be an engineer is very difficult (Year 2 $\chi^2_{(df=1)} = 4.942$, p = 0.026).
- Math and science are extremely important to be successful in engineering (Year 3 $\chi^2_{(df=1)} = 8.907$, p = 0.003).
- Engineering is a challenging and demanding field (Year 3 $\chi^2_{(df=1)} = 5.286$, p = 0.021).

In Year 3, engineers who were familiar with EYL were significantly more likely than engineers who were unfamiliar with EYL to say that they would encourage students interested in engineering to:

- Speak to an engineering student (Year 3 $\chi^2_{(df=1)} = 3.939$, p = 0.047).
- Research colleges that offer engineering programs (Year 3 $\chi^2_{(df=1)} = 6.179$, p = 0.013).
- Visit engineering websites (Year 3 $\chi^2_{(df=1)} = 17.246$, p = 0.000).

In Year 2, engineers who were familiar with EYL were significantly more likely than engineers who were unfamiliar with EYL to report that "engineering is rewarding" ($\chi^2_{(df=1)} = 4.336$, p = 0.037). In Year 3, engineers familiar with EYL were more likely than other engineers to report that engineering offers variety in terms of career tracks ($\chi^2_{(df=1)} = 5.518$, p = 0.019).

EYL Resources

We asked engineers to report which EYL resources they had already used. In Year 2, 26 (6.3%) of the engineers indicated that they had previously used EYL resources. In Year 3, 49 (13.1%) reported that they had. Engineers reported using the following resources.

[20] Included as a response option in Year 3 only.
[21] Included as a response option in Year 3 only.
[22] Included as a response option in Year 3 only.

Table 23:
Which EYL Materials Engineers Have Used

Materials	Year 2 Frequency & Percentage (N = 26)	Year 3 Frequency & Percentage (N = 49)
EYL postcard	14 (53.8%)	14 (28.6%)
Video profiles	9 (34.6%)	16 (32.7%)
EYL poster	4 (15.4%)	15 (30.6%)
EYL website (not specific about which resources on the Web were used)	8 (30.8%)	36 (73.5%)
Presentations	1 (3.8%)	1 (2.0%)
EYL brochure	0 (0.0%)	4 (8.2%)

Note: Percentages add up to greater than 100% because respondents could choose more than one answer.

In Year 2, all 26 engineers (100%) that used EYL resources reported that they were useful or very useful. In Year 3, 46 out of 49 (94%) reported that they were useful or very useful.

We asked engineers about the types of activities they planned to do to help female students learn more about engineering in the future. Table 24 summarizes their responses. In Year 2, the most common choices were:

- Recommend the EYL website to colleagues and high school girls
- Incorporate EYL messages into my outreach programs
- Host an engineering table at a college fair

In Year 3, the first two were the most common responses, tied with "volunteer my time by conducting outreach and promoting engineering."

Table 24:

Activities Engineers Planned to Help Females Learn about Engineering

Activities	Year 2 Frequency & Percentage (N = 411)	Year 3 Frequency & Percentage (N = 375)
Recommend this website to colleagues and high school girls	276 (67.2%)	155 (47.7%)
Incorporate the Engineer Your Life messages into my outreach programs	165 (40.1%)	155 (47.7%)
Distribute Engineer Your Life brochures	60 (14.6%)	44 (13.5%)
Distribute Engineer Your Life posters	36 (8.8%)	19 (5.8%)
Distribute Engineer Your Life postcards	35 (8.5%)	21 (6.5%)

Host an engineering table at a college fair	74 (18.0%)	47 (14.5%)
Publish an article about your life as an engineer	49 (11.9%)	21 (6.5%)
Become a mentor or instructor[a]	14 (3.4%)	101 (31.1%)
Volunteer my time by conducting outreach and promoting engineering[a]	53 (12.9%)	155 (47.7%)
Refer educators to the EYL website[a]	2 (0.5%)	71 (21.8%)
Don't know[a]	2 (0.5%)	94 (28.9%)

[a] These response options were added to the survey in Year 3. They were captured in Year 2 as part of the "Other" category.

Website Only

We asked respondents to report on their favorite aspects of the EYL website. 103 engineers in Year 2 and 50 engineers in Year 3 responded to this question. The following is a list of their favorite aspects of the site:

Table 25:

Engineers' Favorite Areas of the EYL Website

Areas	Year 2 Frequency & Percentage (N = 103)	Year 3 Frequency & Percentage (N = 50)
Learning about the different types of engineering jobs (including salary information and links)	28 (27.2%)	13 (26.0%)
Reading the stories about women engineers	45 (43.7%)	28 (56.0%)
Watching videos	23 (22.3%)	25 (50.0%)
Top Ten Reasons to become an engineer	40 (38.8%)	25 (50.0%)
Advising kids	19 (18.4%)	15 (30.0%)
Getting information about how to become an engineer (Preparing for college, Taking a Test Drive, Looking at Programs, Scholarship Information, etc.)	16 (15.5%)	12 (24.0%)
Information for engineers (What Girls Think About Engineering, What Girls Want from Their Careers, Compelling Engineering Messages, Ways We Can Inspire and Get Involved)	53 (51.5%)	22 (44.0%)
Training others	9 (8.7%)	4 (8.0%)
Identifying potential engineers	10 (9.7%)	7 (14.0%)
Don't know	6 (5.8%)	2 (4.0%)

Among the engineers who reviewed the website, almost all of the engineers (96.1% in Year 2 and 100% in Year 3) reported that the website did a good job of showing what life and work were like for engineers.

Most (88.3% in Year 2 and 97.9% in Year 3) also reported that the website helped them to feel more comfortable helping to prepare high school girls for becoming engineers.

Almost all of the engineers (97.1% in Year 2 and 100% in Year 3) reported that the website helped kids learn about engineering and did a successful job of introducing high school girls to female engineers. All of the engineers (100%) reported that the website helped kids understand that an engineering career is achievable.

All of engineers (100%) indicated that they would recommend the website to a student who is interested in learning more about engineering. Almost all of the engineers (97.1% in Year 2 and 100% in Year 3) reported that they would recommend the website to a colleague.

Some comments added by Year 3 engineers included:

> *I think that women are encouraged by emphasis on relationships. If a project is collaborative and if the project benefits people, animals or the environment, it provides a much greater motivation.*
>
> *EYL is doing a great job. Let's keep inspiring young women to pursue their dreams.*
>
> *EYL is fabulous. If everyone used this in their school curriculum and outreach programs, we'd have more girls considering engineering as a career.*
>
> *Keep up the good work!*
>
> *This is a key area of concern for the country (and the world): getting more young people aware of their options for engineering education. Keep up the great work!*
>
> *Thank you for creating this website.*
>
> *We not only need to work to encourage women to enter engineering, we need to find ways to keep them in engineering.*
>
> *Programs to encourage girls to enter engineering are absolutely necessary! None of my teachers suggested engineering to me in high school, I investigated it myself because my dad is an engineer. Girls without an existing connection to engineering through a family member or friend may never hear about it at all.*
>
> *EYL is a wonderful organization doing wonderful needed work. What we really need is a TV show about the life of an engineer that is exciting and fun.*
>
> *The Women in Engineering Program at the University of Texas at Austin (an EYL partner) has been the greatest tool for me both as a student at UT and now as a recruiter and mentor now that I work in industry. Their pre-college outreach programs to*

elementary-high school students are very well-planned and I think that they have a huge impact on the participants.

Career Counselor/Educator Findings

Participant Characteristics

In Year 1, we invited career counselors to participate in the survey. In Years 2 and 3, we invited counselors *and* educators to participate in the counselor survey since educators may be involved in counseling and guiding students who are interested in exploring different career paths. Moreover, with budget cuts, some districts cannot afford to offer career counseling and must rely on educators to help guide students. Even though our study recruitment procedures did not change, far more educators participated in our Year 3 survey than did counselors (Table 26).

Table 26:

Role of Individuals in the Counselor/Educator Sample

Role	Year 1 Frequency & Percentage (N = 147)	Year 2 Frequency & Percentage (N = 171)	Year 3 Frequency & Percentage (N = 177)
Counselor only*	147 (100.0%)	101 (59.1%)	25 (14.1%)
Counselor and educator	0 (0.0%)	43 (25.1%)	18 (10.2%)
Educator only	0 (0.0%)	27 (15.8%)	134 (75.7%)

*Assumed: We did not ask participants in the Year 1 sample to identify their role, but we only invited counselors to participate in Year 1.

The findings from the counselor surveys in the Year 3 report differs from the Year 2 report in one important way: We have included teachers in the results in the Year 3 report. In reporting on Year 2 findings, we have re-run the analyses to include teachers. So, the Year 2 data reported in the Year 2 report will differ slightly from the Year 2 data reported in the Year 3 report.

The following table summarizes the demographic characteristics of the counselors and educators. As we found in Years 1 and 2, most of the sample was female. The respondents held a wide range of educational degrees and certifications, as well as varying amounts of experience in the field, as outlined in the table below. Year 3 respondents were more likely than other respondents to hold a teaching certificate or have a Bachelor's degree in education. They were also less likely than the other respondents to hold state school counseling certification, have a Bachelor's or a Master's degree in counseling, or to have participated in a counseling practicum or internship. Year 1 respondents were less likely than respondents in the other two years to report that they had a Master's degree in education.

There were no significant differences between the samples with respect to gender or years of experience.

Table 27:

Demographic Data

Characteristics	Year 1 Frequency & Percentage (N = 147)	Year 2 Frequency & Percentage (N = 171)[23]	Year 3 Frequency & Percentage (N = 177)
Gender			
Female	126 (85.7%)	128 (75.7%)	142 (80.2%)
Male	20 (13.6%)	41 (24.3%)	35 (19.8%)
Missing	1 (0.7%)	0 (0.0%)	0 (0.0%)
Education / Certification[a]			
State school counseling certification	62 (42.1%)	41 (24.0%)	5 (2.8%)**
Teaching certificate	38 (25.9%)	59 (34.5%)	104 (58.8%)**
Bachelor's degree in Education	30 (20.4%)	32 (18.7%)	58 (32.8%)**
Bachelor's degree in Counseling	7 (4.8%)	10 (5.8%)	3 (1.7%)**
Master's degree in Education	42 (28.6%)**	66 (38.6%)	73 (41.2%)
Master's degree in Counseling	78 (53.1%)	67 (39.2%)	11 (6.2%)**
Counseling practicum	37 (25.2%)	31 (18.1%)	1 (0.6%)**
Counseling internship / Supervised field experience	39 (26.5%)	34 (19.9%)	4 (2.3%)**
Bachelor's degree in another field	17 (11.6%)	21 (12.3%)	28 (15.8%)
Master's degree in another field or MBA	9 (6.1%)	16 (9.4%)	24 (13.6%)
Doctorate in Education or Counseling	6 (4.1%)	2 (1.2%)	0 (0.0%)
Other certificates or non-specific degrees	15 (10.2%)	20 (11.7%)	19 (10.7%)
Years of Experience			
0-2 years	30 (20.4%)	29 (17.2%)	33 (18.6%)
3-5 years	27 (18.4%)	36 (21.3%)	33 (18.6%)
6-10 years	23 (15.6%)	36 (21.3%)	33 (18.6%)
10-20 years	37 (25.2%)	33 (19.5%)	43 (24.3%)
Greater than 20 years	30 (20.4%)	35 (20.7%)	35 (19.8%)
Missing	0 (0.0%)	2 (1.2%)	0 (0.0%)

[a] Percentages add up to >100% because respondents were able to choose more than one answer.
** Significant at p < .01 level.

The schools that counselors and educators worked for represented a wide range of demographics. Respondents reported working in public, charter, private and home schools with grades 7 - 12. The schools were located in urban, suburban, and rural areas. Table 28 summarizes the specific breakdown of the schools' demographic information.

Year 3 respondents were more likely to be from schools that served seventh and eighth graders and less likely to be from school that served eleventh and twelfth graders than respondents from Year 1 and 2. Year 3 respondents were also more likely to be from public schools and less likely to be from private schools, as compared to respondents from Years 1 and 2.

There were no difference between years with respect to locale or region.

[23] As explained earlier, this report will contain Year 2 data for counselors and teachers. The Year 2 report only included data for counselors.

Table 28:

Schools' Demographic Data

Characteristics	Year 1 Frequency & Percentage	Year 2 Frequency & Percentage	Year 3 Frequency & Percentage
Grade Levels			
Seventh	23 (15.6%)	29 (17.0%)	73 (41.2%)**
Eighth	28 (19.0%)	32 (18.7%)	64 (36.2%)**
Ninth	118 (80.3%)**	100 (58.5%)	88 (49.7%)
Tenth	125 (85.0%)	125 (73.1%)**	109 (61.6%)
Eleventh	138 (93.9%)	145 (84.8%)	104 (58.8%)**
Twelfth	140 (95.2%)	149 (87.1%)	102 (57.6%)**
School Type			
Public (non-charter)	84 (59.6%)	97 (57.7%)	143 (80.8%)**
Public charter	3 (2.1%)	6 (3.6%)	8 (4.5%)
Private or religious school	52 (36.9%)	64 (38.1%)	22 (12.4%)**
Home school	2 (1.4%)	1 (0.6%)	4 (2.3%)
Locale[a]			
Urban	42 (29.4%)	46 (27.4%)	61 (34.5%)
Suburban	77 (53.8%)	92 (54.8%)	73 (41.2%)
Rural	24 (16.8%)	30 (17.9%)	43 (24.3%)
Region of the United States[a]			
Northeast	28 (19.4%)	56 (33.3%)	43 (24.3%)
South	43 (29.9%)	42 (25.0%)	72 (40.7%)
Midwest	17 (11.8%)	29 (17.3%)	33 (18.6%)
West	56 (38.9%)	40 (23.8%)	25 (14.1%)
Pacific	0 (0.0%)	1 (0.6%)	4 (2.3%)

[a] Northeast includes ME, NH, VT, MA, CT, RI, NY, NJ, PA; South includes: MD, DE, DC, WV, VA, NC, SC, GA, FL, KY, TN, AL, MS, LA, AR, OK, TX, Virgin Islands, and Puerto Rico; Midwest includes: MI, WI, IL, IN, OH, ND, SD, NE, KS, MN, IA, MO; West includes: MT, WY, ID, NV, UT, CO, AZ, NM, WA, OR, CA; Pacific includes: AK, HI.
** Significant at $p < .01$ level.

Career Counseling

Student and Parent Participation in Career Counseling

We asked the respondents to report the percentage of students, both male and female, who discussed career opportunities with them. About 20% of Year 3 respondents indicated that 50% or more of their female students discussed career opportunities with them. More Year 3 respondents (22.6%) indicated that 50% or more of their male students discussed career opportunities with them. Respondents in Year 3 were significantly less likely to report that students sought them out for counseling compared to respondents in Years 1 and 2.

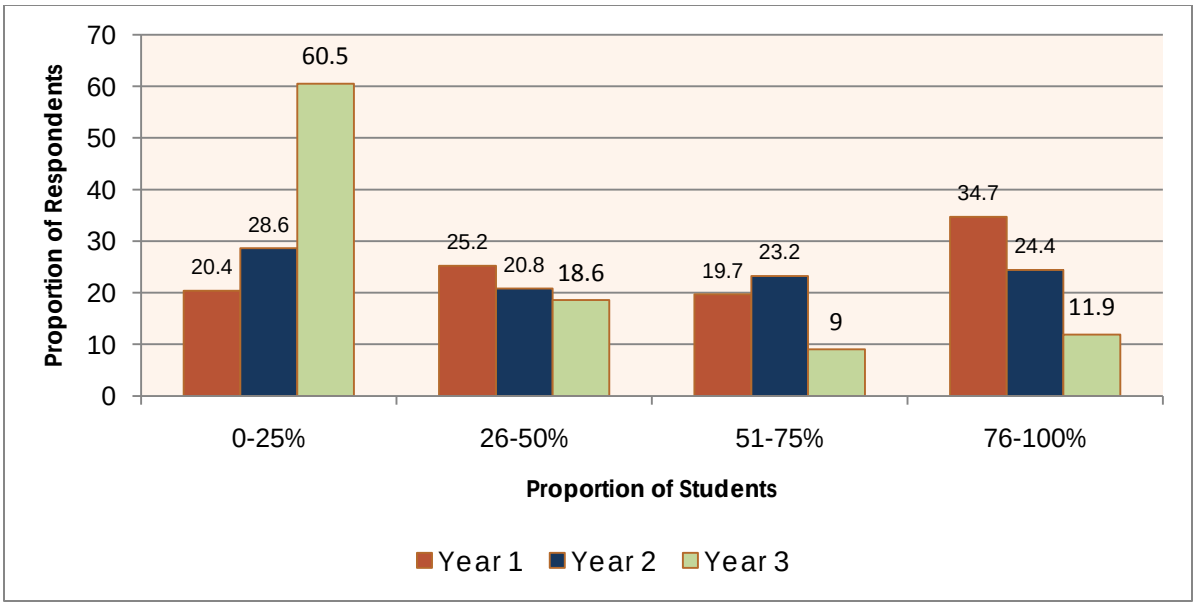


Figure 5. Proportion of Respondents Reporting that Female Students Seek Career Counseling

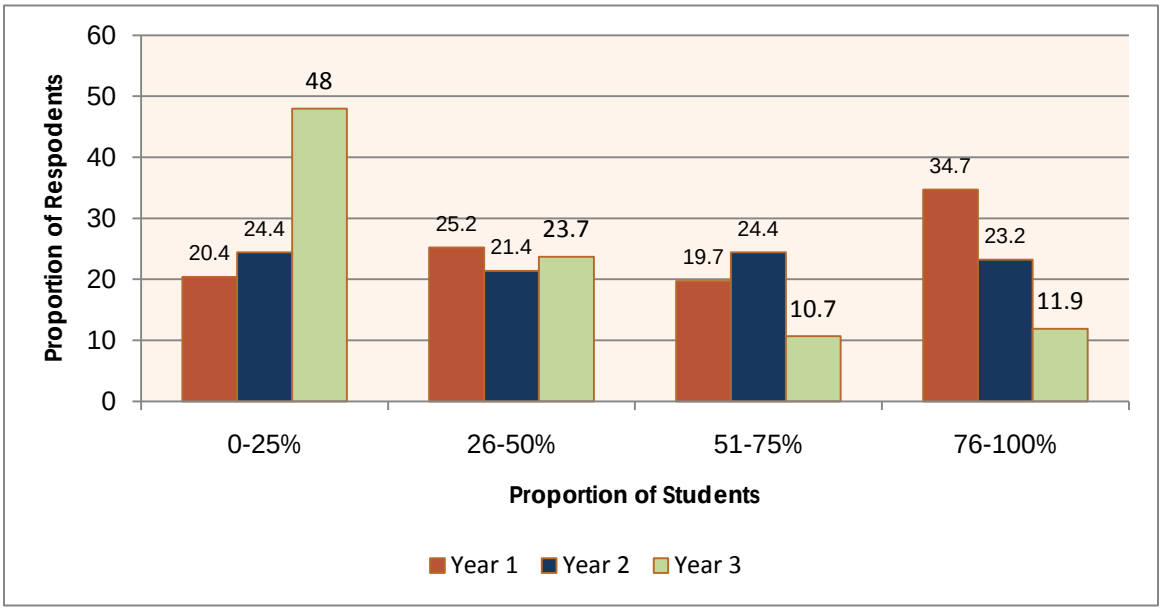


Figure 6. Proportion of Respondents Reporting that Male Students Seek Career Counseling

Across all three years, respondents reported that, at their schools, parents were encouraged to be involved in career planning. In Year 1, 75.3% of the respondents reported that their students' parents were encouraged by the school to be involved in their child's career plans versus 81.6% in Year 2 and 67.8% in Year 3.

Participation in Science and Engineering Activities with Students

We asked the respondents to respond to a series of questions regarding the extent to which they participated in various science and engineering activities with students. As shown in Table 29, Year 3 respondents were more likely than other respondents to report participating in field trips to science museums, science fairs, and robotics competitions. Year 1 respondents were more likely to report that they had encouraged students to take science classes or that they had participated in career exploration days. Year 3 respondents were the least likely to report that they had encouraged students to pursue engineering careers, or that they had participated in Women in Engineering Day or Women in Science Day.

Table 29:

Participation in Activities Designed to Expose Students to Engineering

Science and Engineering Activities	Year 1 (N = 147)	Year 2 (N = 171)	Year 3 (N = 177)
Encouraging students to take science classes	139 (94.6%)**	123 (71.9%)	61 (34.5%)
Recommending specific science classes to students	135 (91.8%)**	115 (67.3%)	89 (50.3%)
Encouraging individual students to pursue engineering careers	128 (87.1%)	132 (77.2%)	126 (71.2%)**
Career exploration days (i.e., students "shadow" or observe professionals)	101 (68.7%)**	92 (53.8%)	62 (35.0%)
Career fairs	99 (67.3%)	76 (44.4%)	58 (32.8%)
Mentoring programs	56 (38.1%)	58 (33.9%)	50 (28.2%)
Science or math summer camp	38 (25.9%)	29 (17.0%)	40 (22.6%)
Field trips to science museums	37 (25.2%)	44 (25.7%)	69 (39.0%)**
Women in Engineering Day	35 (23.8%)	57 (33.3%)	27 (15.3%)**
Women in Science Day	31 (21.1%)	41 (24.0%)	19 (10.7%)**
Science fair	31 (21.1%)	32 (18.7%)	54 (30.5%)*
Robotics competition	26 (17.7%)	35 (20.5%)	55 (31.1%)*
Math team / Mathletes	24 (16.3%)	22 (12.9%)	22 (12.4%)
Science club	22 (15%)	21 (12.3%)	32 (18.1%)
Building or design clubs	17 (11.6%)	22 (12.9%)	35 (19.8%)
Computer club	13 (8.8%)	19 (11.1%)	14 (7.9%)

Note: Percentages add up to >100% because respondents were able to choose more than one answer.
* Significant at the $p < .05$ level.
** Significant at the $p < .01$ level.

Students & Engineering Opportunities

Educational Programs Available to Students

We asked counselors and educators to report on the types of engineering programs available at their schools. As shown in the following table, in Year 1, 55.8% of schools offered engineering content in the general science curriculum. By Year 2, this proportion dropped significantly to 26.9% of schools, and by Year 3, it dropped again to 15.3% of schools ($\chi^2_{(df=2)} = 63.693$, p = 0.000). There was also a reduction in the proportion of schools that offered engineering guest speakers, from 34% in Year 1 to 24% in Year 2 to only 10% in Year 3 ($\chi^2_{(df=2)} = 27.243$, p = 0.000).

From Year 1 to Years 2 and 3, we observed increases in the proportion of schools that offered Technology Prep programs, Project Lead the Way, and collaborations with universities.

Table 30:

Programs Offered at Schools

Programs	Year 1 Frequency & Percent (N = 147)	Year 2 Frequency & Percent (N = 171)	Year 3 Frequency & Percent (N = 177)
Engineering topics/content incorporated into the general science curricula	82 (55.8%)**	46 (26.9%)	27 (15.3%)
Specific engineering classes/program	36 (24.5%)	46 (26.9%)	36 (20.3%)
Engineering extracurricular activities/clubs	46 (31.3%)	56 (32.7%)	57 (32.2%)
Engineering summer programs/camps	25 (17.0%)	N/A	28 (15.8%)
Women in Engineering Day	16 (10.9%)	15 (8.8%)	45 (25.4%)**
Engineering guest speakers	50 (34.0%)	41 (24.0%)	18 (10.2%)**
Representatives at a career fair	44 (29.9%)	43 (25.1%)	30 (16.9%)*
Technology prep programs	8 (5.4%)**	42 (24.6%)	34 (19.2%)
Collaboration with local universities	4 (2.7%)**	42 (24.6%)	28 (15.8%)
Project Lead the Way	1 (0.7%)**	21 (12.3%)	40 (22.6%)

Note: Percentages add up to >100% because respondents were able to choose more than one answer.
N/A = Data were not collected on this question for Year 2.
* Significant at the p < .05 level.
** Significant at the p < .01 level.

Awareness and Appeal of Engineering Opportunities

It is important to note that the following findings are based on data reported by the career counselors and educators; therefore, the reported level of student interest in engineering is only an estimation, and not a direct measurement.

Across all three years, the proportion of respondents who stated that their students were "very aware" or "aware" of engineering career opportunities declined (50.7% in Year 1, 48% in Year 2 and 37.3% in Year 3).

In Year 1, respondents at private/religious schools reported that their students had a significantly higher level of awareness of engineering careers than their public school counterparts. This finding was also replicated in Year 2: Respondents in private schools reported an average awareness level of 3.67 on a scale of 1 to 5 (sd = 0.993) among students while counselors in public schools reported an average awareness level of 3.13 (sd = 0.920) among students ($F_{(3,164)} = 4.322$, p = 0.006). This finding was not replicated in Year 3, however.

Similar to Years 1 and 2, in Year 3 we found a positive correlation between students' awareness of engineering opportunities and the extent to which parents were reportedly encouraged by the schools to be involved in their child's career plans ($r_{(177)} = 0.418$, p = 0.000). Also, there was a positive correlation between how appealing engineering opportunities reportedly were to students and the extent to which parents were encouraged by the schools to be involved in their child's career plans ($r_{(177)} = 0.299$, p = 0.000). The more parents were encouraged to be involved in their children's career plans by the schools, the more respondents perceived the students to be aware of engineering career opportunities and the more appealing engineering career opportunities were perceived to be to students.

There was a positive correlation between students' awareness of engineering opportunities and the opportunities' appeal ($r_{(177)} = 0.503$, p = 0.000). Respondents who reported that students were aware were also likely to report that students found the field to be appealing.

In Year 2, 60.7% of the respondents reported that engineering careers were "very appealing" or "appealing" to their students—an increase over Year 1 when only 39.7% reported that engineering was appealing to their students. In Year 3, this proportion dropped to 52.5%. We compared the average appeal scores (appeal was rated on a scale from 1, not appealing, to 5, very appealing) for each year. Respondents in Year 3 rated engineering as significantly less appealing to their students than respondents in Years 1 and 2 ($F_{(2, 489)} = 8.136$, p = 0.000).

In Years 1 and 2, respondents at private schools reported that their students found engineering careers more appealing than respondents at public schools (Year 1 $F_{(3,137)} = 3.220$, p = 0.025; Year 2 $F_{(3,163)} = 4.359$, p = 0.006). However, we found the opposite in Year 3, where respondents at public schools were more likely than those at private schools to report that their students found engineering careers appealing ($F_{(3,173)} = 3.284$, p = 0.022).

Respondents reported that the engineering programs offered at their schools had a significant impact on their students' awareness of engineering career opportunities, as well as the opportunities' appeal. For example, across all three years, we observed a statistically significant difference between respondents who worked at schools that offered engineering extracurricular activities / clubs and those whose school did not offer engineering activities. Respondents who worked at schools that offered engineering activities were significantly more likely to report that their students were aware of engineering career opportunities than respondents who worked at schools that did not offer engineering activities (Year 1 $t_{(df=144)} = -3.154$, p = 0.002; Year 2 $t_{(df=167)} = -3.178$, p = 0.002; Year 3 $t_{(df=175)} = -4.589$, p = 0.000).

In addition, in Years 2 and 3, respondents who worked at schools that offered engineering activities were more likely to report that their students found engineering careers to be appealing

than respondents who worked at schools that did not offer engineering activities (Year 2 $t_{(df=128.852)} = -4.739$, p = 0.000; Year 3 $t_{(df=175)} = -2.218$, p = 0.028).

In Years 2 and 3, we observed a similar finding for schools that offered building and design clubs. Respondents who worked at schools that offered building and design clubs were more likely to report that their students were aware of engineering career opportunities than respondents who worked at schools that did not offer engineering activities (Year 2 $t_{(df=167)} = -2.407$, p = 0.017; Year 3 $t_{(df=175)} = -2.057$, p = 0.041).

Some of the findings were not replicated from year to year. For example, in Years 1 and 3, we found a statistically significant difference between respondents who worked at schools that offered engineering content incorporated into the general science curriculum and those whose school did not offer engineering content. Respondents whose schools offered engineering content incorporated into the general science curriculum were more likely to report that their students were aware of engineering career opportunities than respondents who worked at schools that did not offer engineering content (Year 1 $t_{(df=144)} = 3.708$, p = 0.000; Year 3 $t_{(df=175)} = -2.666$, p = 0.008).

We also found that respondents who worked at schools that offered engineering content incorporated into the general science curriculum were more likely to report that engineering career opportunities were appealing to their students than respondents who worked at schools that did not offer engineering content (Year 1 $t_{(df=144)} = 2.290$, p = 0.023; Year 3 $t_{(df=175)} = -2.458$, p = 0.015). We did not observe these same relationships in Year 2.

Also in Years 1 and 3, there was a statistically significant difference between respondents who worked at schools that offered specific engineering classes and those whose school did not offer engineering classes. Respondents who worked at schools that offered specific engineering classes were more likely to report that their students were aware of engineering career opportunities than respondents who worked at schools that did not offer engineering classes (Year 1 $t_{(df=144)} = -2.221$, p = 0.028; Year 3 $t_{(df=175)} = -3.340$, p = 0.001).

Finally, in Years 1 and 2, there was a statistically significant difference between respondents who worked at schools that offered engineering guest speakers and those whose schools did not offer engineering speakers. Respondents who worked at schools that offered engineer guest speakers were more likely to report that their students were aware of engineering career opportunities than respondents who worked at schools that did not offer engineer speakers (Year 1 $t_{(df=144)} = 3.127$, p = 0.002; Year 2 $t_{(df=167)} = -2.618$, p = 0.010). In addition, respondents who worked at schools that offered engineer guest speakers were more likely to report that engineering career opportunities were appealing to their students than respondents who worked at schools that did not offer engineer guest speakers (Year 1 $t_{(df=144)} = 2.332$, p = 0.021; Year 2 $t_{(df=166)} = -2.484$, p = 0.014). We did not observe these same relationships in Year 3.

Respondents' Perceptions of Students' Interest in Engineering

We asked the respondents to report what percentage of students, both male and female, have expressed an interest in becoming an engineer. According to respondents, very few students have expressed interest in an engineering career. Refer to the figures below for the percentages of students whom the respondents reported have expressed an interest in becoming an engineer.

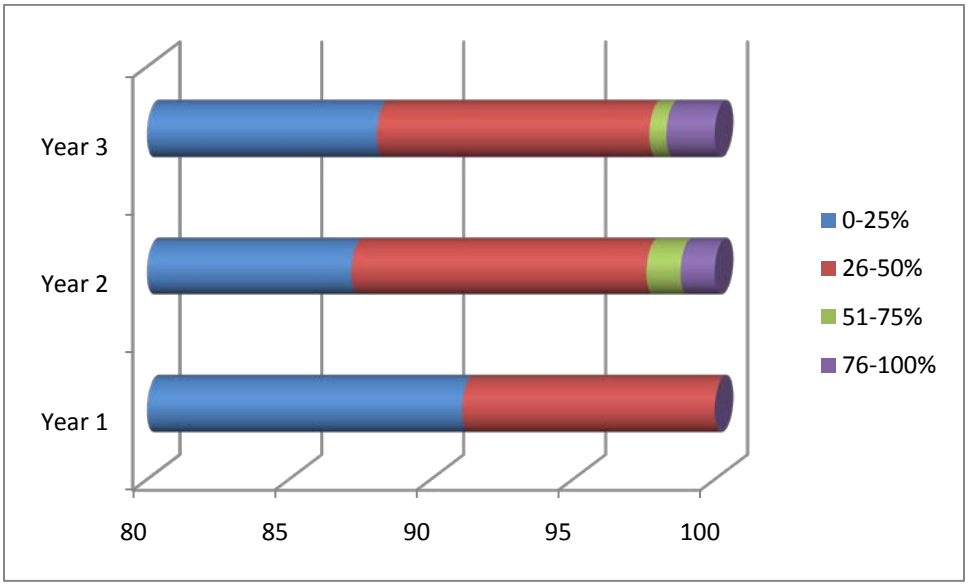


Figure 7: Proportion of Respondents Who Reported that *Female* Students Were Interested in Engineering Careers

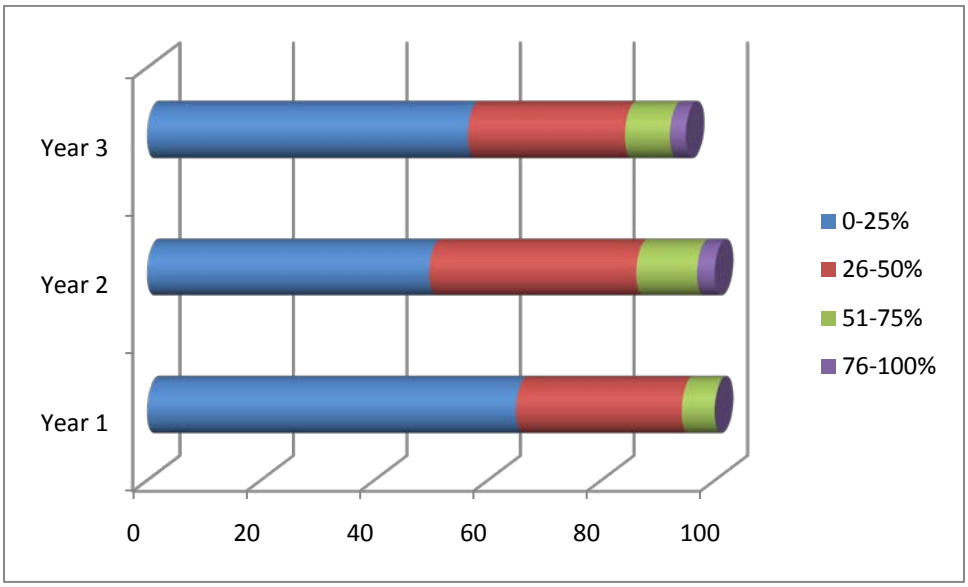


Figure 8: Proportion of Respondents Who Reported that *Male* Students Were Interested in Engineering Careers

Consider the following statistics:

- In all years, almost all of the respondents indicated that fewer than 50% of their female students had expressed an interest in an engineering career (100% of the respondents in Year 1; 93.6% in Year 2; 97.7% in Year 3).
- The situation for male students was only slightly, but not statistically, better: In Year 1, 94.2% of respondents reported that fewer than 50% of their male students had expressed an interest in an engineering career. In Years 2 and 3, 86.2% and 84.2% reported this observation, respectively. The difference between the reported interest level among male and female students was statistically significant in Years 1 and 3 (binomial test of proportions: $p = .002$ and $p = .022$, respectively)

Respondents' Perceptions of Students' Capabilities

In Year 3, 78.5% of the respondents "strongly disagreed" or "disagreed" with the statement that boys are better at math and science than girls. However, 6.2% of the respondents "strongly agreed" or "agreed" that boys are better at math and science than girls. These findings are consistent with those from Years 1 and 2.

Similarly, 88.7% of the respondent respondents "strongly disagreed" or "disagreed" with the statement that boys were more suited for engineering than girls (Only 2.2% "agreed" and 9.0% were "neutral" to the statement).

Across all three years, there was a positive correlation between the respondents who reported that boys are better at math and science and those who reported that boys are *more suited* for engineering than girls. Respondents who agreed that boys were better at math and science than girls also tended to agree that boys were more suited for engineering than girls.

Also across all three years, there was a negative correlation between beliefs that boys were more suited for engineering than girls and confidence that women can succeed in both a high school engineering curriculum and an engineering career. The higher the respondents' confidence in female students' ability to succeed in a high school engineering curriculum and engineering career, the more they likely they were to disagree that boys are better suited for engineering. In Year 3, 84.8% "strongly agreed" or "agreed" that boys were more encouraged to pursue engineering than girls. This finding echoes the engineer finding that guidance and career respondents and employers are not doing enough to encourage women to enter the engineering industry. This finding is also consistent with Years 1 and 2.

Regardless of suitability and encouragement to pursue engineering, in Year 3, 99.4% of respondents were "very confident" or "confident" that women can succeed in an engineering high school curriculum; 98.9% were "very confident" or "confident" that women can succeed in an engineering college curriculum; and 98.9% were "very confident" or "confident" that women can succeed in engineering careers.

As in Years 1 and 2, we found a positive correlation between confidence that female students can succeed in a high school engineering curriculum and the confidence that female students can

succeed in a college engineering curriculum ($r_{(177)} = 0.748$, p = 0.000). The higher the respondents' confidence that female students can succeed in a high school curriculum, the higher their confidence that females can succeed in a college curriculum.

We also found a positive correlation between confidence that female students can succeed in a high school engineering curriculum and the confidence that females can succeed in an engineering career ($r_{(177)} = 0.659$, p = 0.000). The higher the respondents' confidence that female students can succeed in a high school curriculum, the higher their confidence that females can succeed in an engineering career. This echoes the findings from Years 1 and 2.

Finally, there was a positive correlation between respondent confidence that female students can succeed in a college engineering curriculum and respondent confidence that females can succeed in an engineering career ($r_{(177)} = 0.700$, p = 0.000). The higher the respondents' confidence that female students can succeed in a college curriculum, the higher their confidence that females can succeed in an engineering career. This also echoes findings from Years 1 and 2.

Respondents' Engineering Attitudes and Knowledge

Overall Engineering Knowledge (Self-Reported)

In Year 3, more than half of the respondents (59.4%) reported that they felt "very knowledgeable" or "knowledgeable" about engineering career opportunities. This finding is consistent with Years 1 and 2 results (65.1% and 64.5%, respectively).

In Year 3, we found that respondents who were familiar with EYL were significantly more knowledgeable about engineering career opportunities ($t_{(143.808)} = -3.723$, p = 0.000).

In Years 1 and 2, respondents' participation in various science and engineering activities also appeared to have had a significant impact on their reported personal knowledge of engineering career opportunities—but the impact of the activities varied from year to year. For example:

- In Year 1, there was a statistically significant difference in knowledge between respondents who participated in career exploration days and those who did not participate ($t_{(df=127)} = -2.305$, p = 0.044). More respondents who participated in career exploration days were knowledgeable about engineering career opportunities than respondents who did not participate in career exploration days. We did not observe this difference in Year 2 or 3.
- In Years 1 and 3, there was a statistically significant difference in knowledge between respondents who participated in Women in Engineering Day and those who did not participate (Year 1 $t_{(df=88.401)} = -3.208$, p = 0.002; Year 3 $t_{(df=38.046)} = -2.676$, p = 0.011). Respondents who participated in Women in Engineering Day reported they were more knowledgeable about engineering career opportunities than respondents who did not participate in Women in Engineering Day. Again, we did not observe this difference in Year 2.
- Finally, in Year 2, there was a statistically significant difference in knowledge between respondents who participated in math team and those who did not participate. Respondents who participated in math team reported having more knowledge about

engineering careers than respondents who did not participate in math team ($t_{(df=46.997)}$ = -3.467, p = 0.002). We did not observe this difference in Years 1 or 3.

Respondents also reported that the engineering programs offered at their school had a significant impact on their reported personal knowledge of engineering career opportunities.

- In Years 1 and 3, there was a statistically significant difference between respondents who worked at a school that offered engineer guest speakers and those whose school did not offer engineer speakers (Year 1 $t_{(df=127)}$ = -2.133, p = 0.035; Year 3 $t_{(df=24.891)}$ = -3.256, p = 0.003). More respondents who worked at schools that offered engineer guest speakers reported that they were knowledgeable about engineering career opportunities than respondents who worked at schools that did not offer engineer speakers. We did not observe this difference in Year 2.
- In Years 1 and 3, there was a statistically significant difference between respondents who worked at schools that offered engineer representatives at career fairs and those whose school did not offer engineer representatives (Year 1 $t_{(df=85.376)}$ = -2.610, p = 0.011; Year 3 $t_{(df=53.893)}$ = -2.877, p = 0.006). Respondents who worked at schools that offered engineer representatives at career fairs reported that they were more knowledgeable about engineering career opportunities than respondents who worked at a school that did not offer engineer representatives. We did not observe this difference in Year 2.
- Finally, in Years 1 and 3, we found a positive correlation between the total number of programs offered at each school and the respondents' engineering knowledge level (Year 1 $r_{(129)}$ = .236, p = 0.007; Year 3 $r_{(177)}$ = .439, p = 0.000). The more programs offered at the school, the higher the respondents' self-reported knowledge level of engineering. We did not observe this relationship in Year 2.

Knowledge of Academic Subjects Associated with Engineering

We asked the respondents to answer a series of questions regarding the academic subjects in which future engineers should enroll. The following graph illustrates the subjects and the percentage of respondents that consider each subject necessary for engineering. Most respondents were aware of the need for students to take physics, math, chemistry and general science in order to pursue a degree in engineering. In addition, more than two-thirds were also aware of the benefits of taking English classes. Year 1 respondents were significantly *less likely* to believe that debate was an important academic subject for engineering than were respondents in Years 2 and 3.

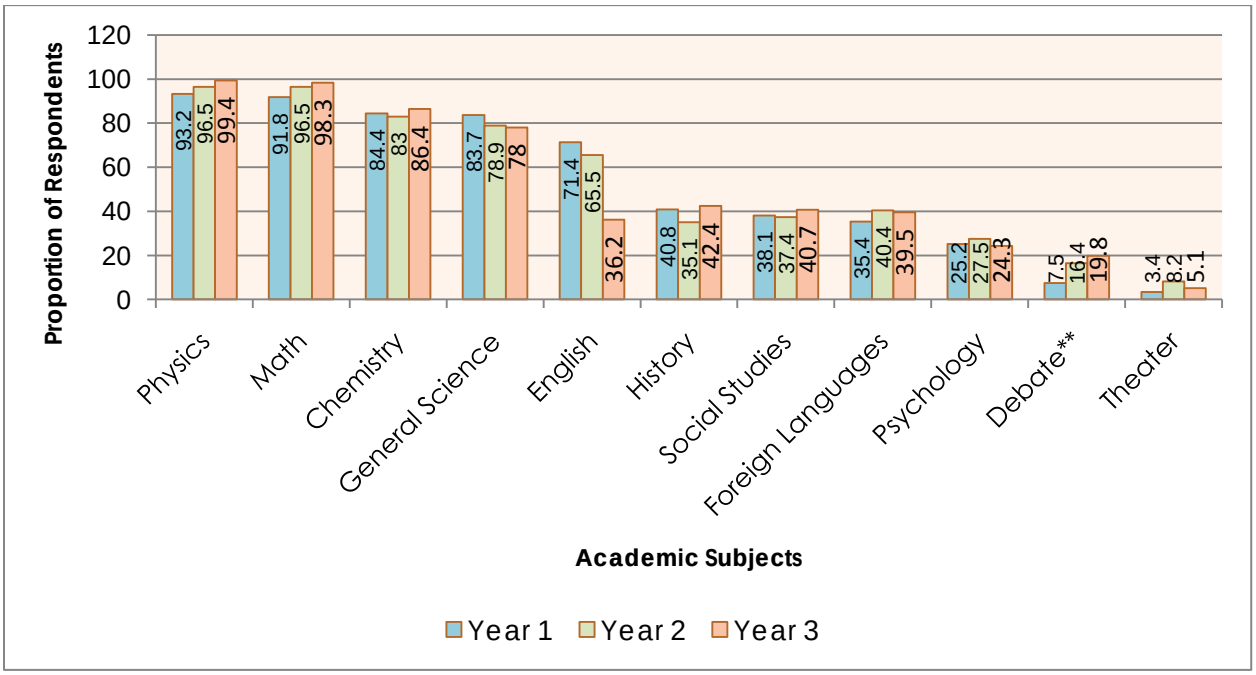
Although fewer than half of the respondents believed there was a need for future engineers to study a broad range of academic subjects, including history, psychology and foreign languages, there were significant differences with respect to the respondents' knowledge of engineering careers and the subjects they cited as important. For example, in Years 1 and 2 respondents who were reportedly "knowledgeable" or "very knowledgeable" about engineering career opportunities were significantly *more likely* to recognize the need for the following non-traditional subjects than respondents who were reportedly less knowledgeable about engineering career opportunities:

- History (Year 1 $\chi^2_{(df=1)}$ = 5.985, p = 0.014)

- English (Year 1 $\chi^2_{(df=1)} = 9.834$, p = 0.002; Year 2 $\chi^2_{(df=1)} = 4.178$, p = 0.041)
- Foreign languages (Year 1 $\chi^2_{(df=1)} = 11.636$, p = 0.001; Year 2 $\chi^2_{(df=1)} = 5.941$, p = 0.015)
- Psychology (Year 2 $\chi^2_{(df=1)} = 3.898$, p = 0.048)
- Theater (Year 2 $\chi^2_{(df=1)} = 4.305$, p = 0.038)

We did not observe these differences in Year 3. Nor did we observe any differences based on exposure to EYL.

Finally, in Years 1 and 2, there was a positive correlation between the sum of subjects needed for engineering and the respondents' self-reported knowledge level (Year 1 $r_{(129)} = .301$, p = 0.001; Year 2 $r_{(169)} = 0.223$, p = 0.004). In other words, respondents who were reportedly knowledgeable about engineering careers recognized that more school subjects were needed to become an engineer. We did not observe this relationship in Year 3 nor did we observe differences based on familiarity with EYL.

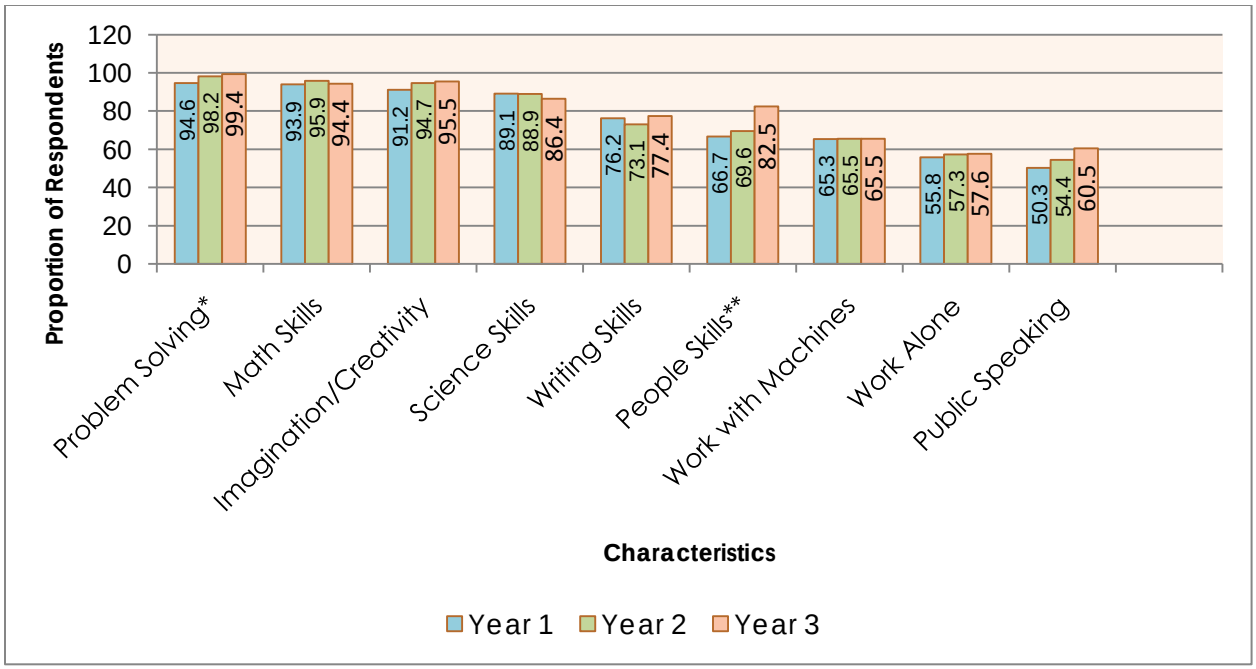


Note: Percentages add up to >100% because respondents were able to choose more than one answer.
** Significant at the p < .01 level.

Figure 9. Academic Subjects that Respondents Believed were Necessary to Become an Engineer

Knowledge of Abilities Associated with Engineering

We asked respondents to answer a series of questions regarding the abilities potential engineers should exhibit. The following graph outlines the capabilities that the respondent respondents considered important to be a successful engineer, providing insight into what information they would pass along to students.



Note: Percentages add up to >100% because respondents were able to choose more than one answer.
* Significant at the p < .05 level.
** Significant at the p < .01 level.

Figure 10. Abilities Respondents Consider Important to be a Successful Engineer

As shown above, good problem solving skills, ability in math, imagination and creativity, and ability in science were cited most often as important skills and characteristics in order to be a successful engineer. This was true across all three years. Good writing skills, good people skills, ability to work with machines, ability to work alone, and good public speaking skills were also cited by more than half (50%) of the respondents. Respondents in Year 1 were less likely than respondents in Years 2 and 3 to cite problem solving skills as important, while respondents in Year 3 were more likely than other respondents to cite people skills as important.

We found significant differences with respect to respondents' reported knowledge level of engineering careers and the skills they cited as important. For example, respondents who reported they were "knowledgeable" or "very knowledgeable" about engineering careers were more likely than respondents who were less knowledgeable to recognize the following abilities as important:

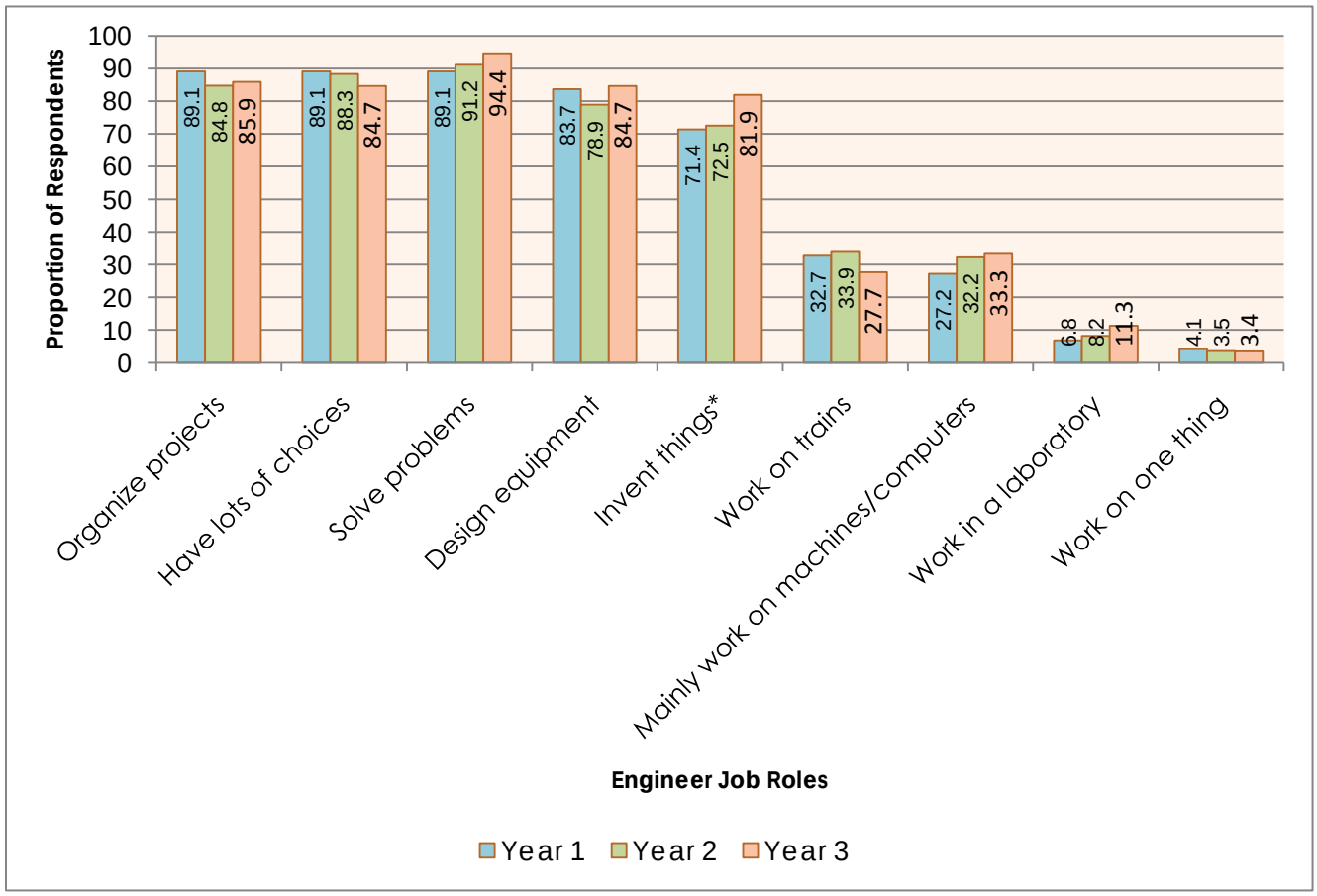
- Problem solving (Year 1 $\chi^2_{(df=1)} = 5.092$, $p = 0.024$)
- Math (Year 1 $\chi^2_{(df=1)} = 6.413$, $p = 0.011$)
- Imagination and creativity (Year 1 $\chi^2_{(df=1)} = 5.318$, $p = 0.021$)
- Public speaking (Year 1 $\chi^2_{(df=1)} = 5.783$, $p = 0.016$)
- People skills (Year 2 $\chi^2_{(df=1)} = 6.991$, $p = 0.008$)

We did not observe these differences in Year 3 nor did we observe differences related to knowledge of EYL.

Knowledge of Engineering Job Roles

We asked the respondents to answer a series of questions regarding the tasks that engineers complete. The following graph outlines the tasks that the respondent respondents cited as engineers' job roles.

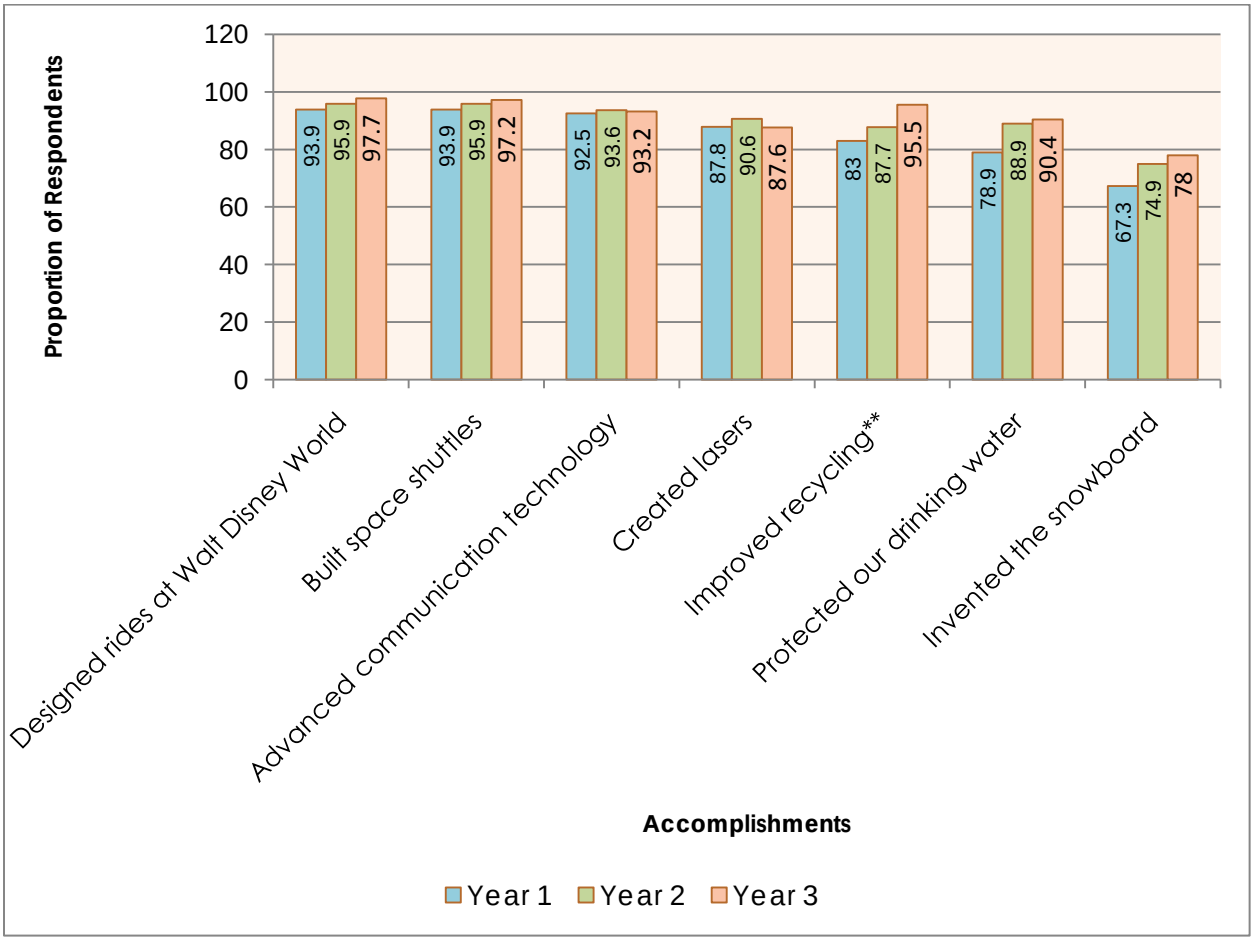
The majority of respondent respondents were aware that engineers have a lot of choices about what they can do in their jobs and were familiar with the engineering roles of organizing projects, problem solving, inventing and designing equipment. Respondents in Year 3 were more likely than respondents in the other two years to recognize that engineers invent things. We did not observe any differences based on familiarity with EYL.



Note: Percentages add up to >100% because respondents were able to choose more than one answer.
** Significant at the p < .05 level.

Figure 11. Respondents' Perceptions of Engineer Job Roles

The survey also included questions designed to determine whether the respondents could identify some major accomplishments attributable to engineers. The majority of respondents were aware of these accomplishments. The following graph illustrates the percentage of respondents who reported that each accomplishment could be attributed to engineers. Respondents in Year 3 were more likely than respondents in the other two years to recognize that engineers have played a role in improving the recycling process. There were no differences based on exposure to EYL.



Note: Percentages add up to >100% because respondents were able to choose more than one answer.
** Significant at the p < .01 level.

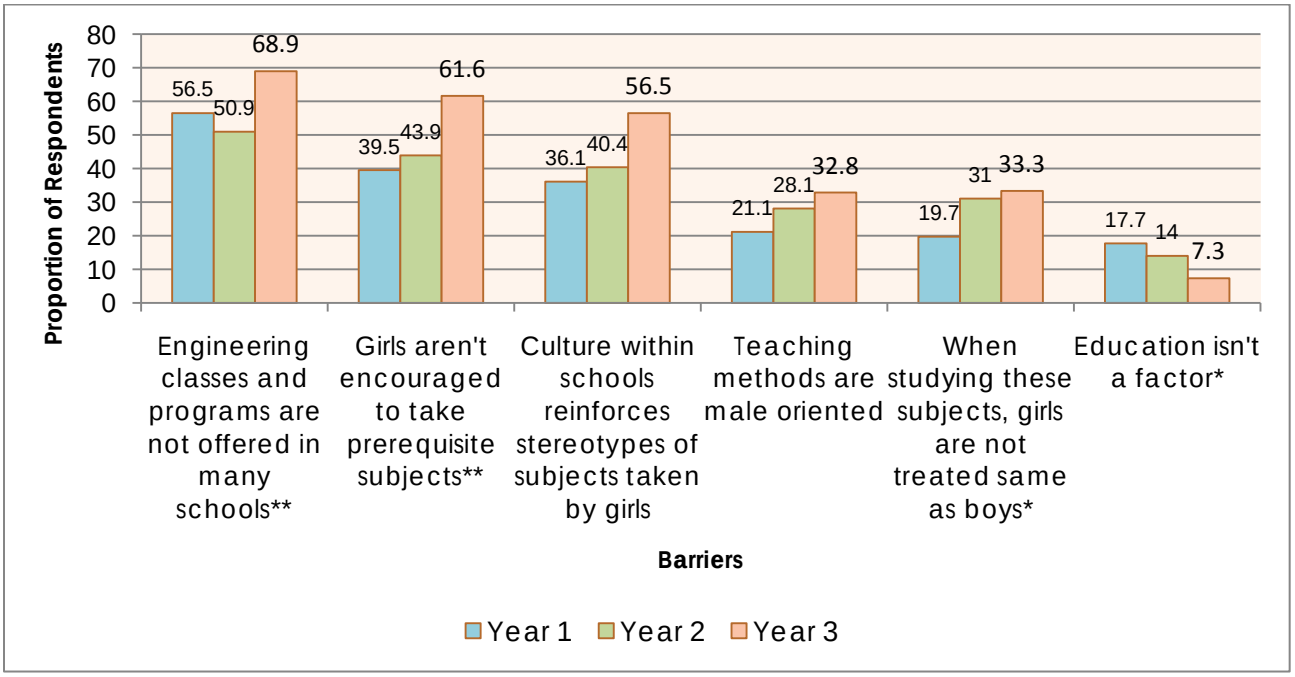
Figure 12. Accomplishments Attributed to Engineers by Respondents

Barriers to Women Entering the Field of Engineering

The majority of the respondents across all years reported that they perceived both educational and non-educational barriers to entry for women into the profession. In Year 1, almost ten percent (9.5%) of the respondents reported that there were no perceived barriers to women entering the engineering profession. In Year 2, more respondents reported that there were no perceived barriers for women (12.3%). But, by Year 3, only 6.8% of respondents failed to perceive any barriers.

Educational Barriers

Most respondents reported that educational factors are a barrier to entry into the field of engineering for women, especially the lack of engineering classes and program offerings in many schools. These respondents also cited the educational barriers summarized in the following figure. We found that respondents in Year 3 were less likely to report that education wasn't a factor. We also found that Year 3 respondents were more likely to report that engineering classes and programs are not offered in many schools and that girls are not encouraged to take prerequisite subjects as often as boys are.

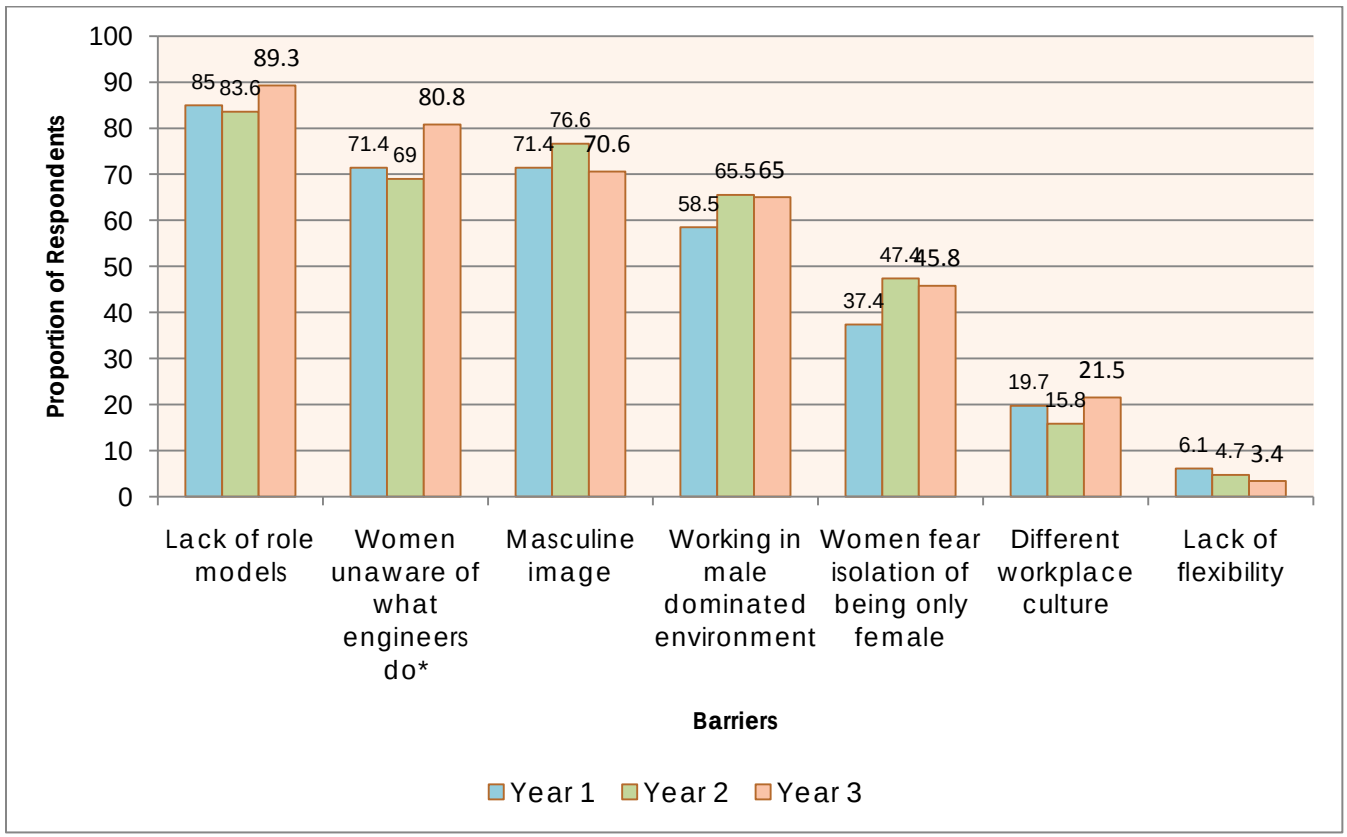


Note: Percentages add up to >100% because respondents were able to choose more than one answer.
* Significant at the p < .05 level.
** Significant at the p < .01 level.

Figure 13. Educational Factors Perceived as Barriers to Women Entering Engineering

Non-Education Barriers

More than half of the respondents reported that there were several non-educational barriers to women entering the field of engineering, including a lack of female role models, women being unaware of what engineers do, the masculine image associated with engineering, and aversion to working in a male-dominated environment. We found that respondents in Year 3 were more likely than other respondents to indicate that women are unaware of what engineers do.



Note: Percentages add up to >100% because respondents were able to choose more than one answer.
* Significant at the p < .05 level.

Figure 14. Non-educational Factors Perceived as Barriers to Women Entering Engineering

Experience with Engineer Your Life

Familiarity with EYL

In Year 2, after the launch of the Engineer Your Life website, we added several questions to the respondent survey about their knowledge of, and experience with, the website and other EYL resources. This section summarizes our findings from Years 2 and 3.

In Year 2, 49 (28.0%) reported that they had heard about EYL before receiving an invitation to participate in the survey. In Year 3, 67 (37.9%) reported they had. Those who had heard about EYL reported hearing about it from various sources. In Year 2, the most common sources of information about EYL included: colleagues, the NACAC listserv, finding the EYL website, and receiving EYL materials in the mail. In Year 3, the most common sources were: finding the website, colleagues, receiving information in the mail, and articles in journals or magazines.

Table 31:

Where Respondents Heard about EYL

Source	Year 2 Frequency & Percentage (N = 49)	Year 3 Frequency & Percentage (N = 67)
Colleague	13 (26.5%)	19 (28.4%)
NACAC listserv	13 (26.5%)	0 (0.0%)
I found the EYL website (Google, etc.)	11 (22.4%)	35 (52.2%)
Received EYL materials in the mail	10 (20.4%)	8 (11.9%)
College fair	7 (14.3%)	3 (4.5%)
Articles in journals or magazines	7 (14.3%)	8 (11.9%)
NACAC conference	6 (12.2%)	1 (1.5%)
ITEA website	4 (8.2%)	0 (0.0%)
Friend or family member	3 (6.1%)	2 (3.0%)
NACAC website	3 (6.1%)	0 (0.0%)
Engineering association	2 (4.1%)	1 (1.5%)
STEM Summits	2 (4.1%)	0 (0.0%)
Science Friday on NPR	2 (4.1%)	0 (0.0%)
Other (National Engineering Week Foundation website, Idahoea.org, College Board conference, NACAC newsletter, National Science Association newsletter, asee.org, Discover Engineering, Girl Scouts)	6 (12.2%)	15 (22.4%)

Note: Percentages add up to greater than 100% because respondents could choose more than one source.

In Year 3, we found that respondents who were familiar with EYL were significantly more knowledgeable about engineering career opportunities than respondents who were unfamiliar with EYL ($t_{(143.808)} = -3.723$, $p = 0.000$).

In Year 2, we found that respondents who had previously heard of EYL were far more likely to be from schools that did *not* offer specific engineering classes *nor* did their schools offer engineering in their science curricula. But, we did not observe this relationship in Year 3.

EYL Resources

We asked respondents to report which EYL resources they had already used. In Year 2, 23 (13.1%) of the respondents indicated that they had previously used EYL resources in counseling students. In Year 3, 33 (18.6%) reported that they had. Respondents reported using the following resources.

Table 32:

Which EYL Materials Respondents Have Used when Advising Students

Materials	Year 2 Frequency & Percentage (N = 23)	Year 3 Frequency & Percentage (N = 33)
EYL website (non-specific)	13 (56.5%)	25 (75.8%)
EYL brochure	7 (30.4%)	2 (6.1%)
EYL poster	7 (30.4%)	9 (5.1%)
Video profiles	5 (21.7%)	13 (7.3%)
EYL postcard	2 (8.7%)	7 (4.0%)
Design Squad episodes	1 (4.3%)	0 (0.0%)

Note: Percentages may add up to greater than 100% because respondents could choose more than one answer.

Most respondents (100% in Year 2 and 94% in Year 3) that had previously used EYL resources reported that the resources they used were useful or very useful.

We also asked all the respondents in the study to report which EYL materials they thought they *might* use when advising their students in the future. The following table summarizes their responses. The most common responses were the EYL website, the brochure, and the poster.

Table 33:

Which EYL Materials Respondents Plan to Use when Advising Students

Materials	Year 2 Frequency & Percentage (N = 171)	Year 3 Frequency & Percentage (N = 177)
EYL website	119 (69.6%)	146 (82.5%)
EYL brochure	68 (39.8%)	82 (46.3%)
EYL poster	56 (32.7%)	97 (54.8%)
EYL postcard	24 (14.0%)	54 (30.5%)

Materials	Year 2 Frequency & Percentage (N = 171)	Year 3 Frequency & Percentage (N = 177)
Video profiles	71 (41.5%)	117 (66.1%)
Design Squad episodes	32 (18.7%)	76 (42.9%)
Take Engineering for Test Drive pdf	53 (31.0%)	87 (49.2%)
High School Coursework Recommendations pdf	90 (52.6%)	86 (48.6%)
Tips for researching engineering schools pdf	101 (59.1%)	80 (45.2%)
Scholarships and financial aid information pdf	91 (53.2%)	86 (48.6%)
Other resources that are not included on the EYL Web site, e.g., College Board resources, Try Engineering.org, etc.	23 (13.5%)	11 (6.2%)

Note: Percentages may add up to greater than 100% because respondents could choose more than one answer.

We asked respondents what advice they would offer to students who were interested in pursuing a career in engineering. Table 34 summarizes their responses. Across both years, the most common suggestions were to:

- Take a tour of a college engineering program
- Talk to an engineer or engineering student
- Attend a summer or afterschool program focused on engineering
- Visit the EYL website

Table 34:

Advice Respondents Would Give to Students Interested in Engineering

Advice	Year 2 Frequency & Percentage (N = 171)	Year 3 Frequency & Percentage (N = 177)
Take a tour of a college engineering program	140 (81.9%)	131 (74.0%)
Talk to an engineer or engineering student	138 (80.7%)	146 (82.5%)
Attend a summer or after school program on engineering	139 (81.3%)	140 (79.1%)
Visit the Engineer Your Life website	121 (70.8%)	164 (92.7%)
Find an engineering internship or summer job	116 (67.8%)	118 (66.7%)
Participate in engineering activities at your high school	98 (57.3%)	122 (68.9%)
Enter an engineering design contest	60 (35.1%)	86 (48.6%)
Watch Design Squad on television	29 (17.0%)	72 (40.7%)

Note: Percentages may add up to greater than 100% because respondents could choose more than one answer.

Website Only

We asked respondents to report on their favorite aspects of the EYL website. The following is a list of favorite aspects of the site:

Table 35:

Respondents' Favorite Areas of the EYL Website

Areas	Year 2 Frequency & Percentage (N = 23)	Year 3 Frequency & Percentage (N = 31)
Learning about the different types of engineering jobs (including salary information and links)	12 (52.2%)	13 (41.9%)
Reading the stories about women engineers	11 (47.8%)	21 (67.7%)
Watching videos	10 (43.5%)	17 (54.8%)
Top Ten Reasons to become an engineer	9 (39.1%)	20 (64.5%)
Advising kids	9 (39.1%)	12 (38.7%)
Getting information about how to become an engineer (Preparing for college, Taking a Test Drive, Looking at Programs, Scholarship Information, etc.)	8 (34.8%)	12 (38.7%)
Information for engineers (What Girls Think About Engineering, What Girls Want from Their Careers, Compelling Engineering Messages, Ways We Can Inspire and Get Involved)	8 (34.8%)	17 (54.8%)
Training others	5 (21.7%)	5 (16.1%)
Identifying potential engineers	3 (12.4%)	8 (25.8%)

We asked the respondents to report how much the website changed their own level of interest in the field of engineering, if at all. More than half reported that it made them more interested in engineering (52.2% in Year 2 and 54.8% in Year 3).

Most of the respondents also reported that the website did a good job of helping them understand what they should do to prepare high school girls to become engineers (e.g., what classes to take and how to prepare for college) (96% in Year 2 and 97% in Year 3).

Most respondents (95.7% in Year 2 and 100% in Year 3) reported that the website did a good job of showing what life and work are like for different engineers.

All respondents (100%) reported that the website helps to teach kids about engineering, that it helps kids understand that an engineering career is achievable, and that it does a successful job of introducing high school girls to young women engineers.

All respondents (100%) reported that they would visit the website again and recommend the website to others, including other respondents and students.

Some comments added by Year 3 respondents included:

I think this site is great! At the beginning of my college years, I was an engineering major. But I felt very alone as a female and didn't feel much support. I was afraid that the isolation I felt in my classes would reflect how I felt on the job. So I changed to math which had more females in it. I teach high school math , but part of me has regretted not becoming an engineer. I think if I had a good female role model that was an engineer, I wouldn't have changed majors. So I want to tell my students about this website and really encourage them, especially the girls, to explore this career. Thank you for having this!

I love your website. I would love to see more videos, but don't get rid of the ones you have.

I love the engineer your life website!

Your website is very encouraging. It reflects a look or image that teenage girls can connect to. Emphasis should be placed on pursuing middle school girls. By the time they get to high school, they will have decided whether math and science classes are their forte. If not, they'll never elect to take an engineering or computer science class.

I am thrilled to discover this web site and plan to incorporate it into my science curriculum next year. I encourage all my students to look at engineering as an option and love all the resources you have provided.

I work in an alternative high school. I feel that exposure to the field of engineering may appeal to many of our students both male and female.

EYL Partner Findings

In June and July of 2010, CEG conducted seven (7) one-on-one interviews with EYL coalition members. The members were identified by WGBH and represented the following organizations:

- University of Colorado at Boulder
- Project Lead the Way (PLTW) (We interviewed 2 coalition members from PLTW)
- Society of Women Engineers (SWE)
- National Academy of Engineering
- University of Texas at Austin
- Boston Area Girls STEM Collaborative

Following are the key findings from the coalition member interviews.

EYL coalition members reported that EYL's message about engineering is helping them, as coalition members, represent engineering to girls in a meaningful way.

Coalition members reported that EYL's emphasis on engineering as a philanthropic and creative field has changed the way they represent engineering careers to girls. Moreover, members reported that the way EYL represented engineering was effective in reaching their target audience.

For example, one member described EYL's language as "easy language" that girls could relate to and understand. In fact, several members commented that they rely on EYL's approach when they speak at events and work with students, often taking language directly from the EYL web site.

A few members said:

> *"It's enormously helpful to me to know how to engage young women in the dialogue….for example, knowing that young women want to be nurturers and help society. When I present STEM, I know that I can cite examples of people who are changing the world and helping society as a female engineer." —Boston Area Girls STEM Collaborative*

> *"I got (the language) directly from (the EYL) website, and I go into high schools and talk to students about taking classes at the college. And I rearranged how I talked to students in an auditorium to make it more appealing, to say 'if you want to do this in your career, if you want to help people, then you should go into engineering,' instead of saying 'if you really like math and science, then you'll like engineering.'" —PLTW*

> *"What they do is extremely important because it fills this gap. I think they're achieving their goals really well. From my perspective…I'm now able to provide a resource…that gives parents, engineers, educators, and students, an opportunity to see real women working as real engineers, and see them as whole people, and also people who are creative and changing the world… —SWE*

"… I hear our faculty say things like 'I love my job because I get to be creative' or 'I love that I get to change the world by designing…' and they really embrace it...To hear them actually use the words that EYL is advocating for us to use is huge." —University of Texas and Austin

As reported in Year 2, EYL coalition members reported that they use a wide cross-section of EYL materials to supplement or structure their own programs and enhance their own messaging.

In many cases, members used the resources and guidelines that are provided on the EYL website. They commented:

"We do three signature events every year… and in each of those events I bring in EYL material. We hang up posters, we distribute either the postcards of the tri-fold brochures. So, we see about 200 girls and 100 parents at those events, and we promote the resource that way…" —SWE

"EYL did a webinar on 'changing the conversation,' and we posted that on our site. And it's now a training resource on our site..." —SWE

"I recently had sixty-four 8th grade girls come over to the college for an event, and the EYL website had some guidelines for how to set up an event …It was so nice…(the site recommended having) women engineers as speakers, doing projects, inviting parents, and provided sample invitations…And the event was really successful. The girls really liked it….and we did a project and made a hovercraft with balloons!" —PLTW

"One of our main goals – is to really increase our precollege student participants' interest in, perception of, (and) understanding of engineering. And so the resources available through EYL are integrated into everything we do." —University of Texas at Austin

Also as reported in Year 2, EYL coalition members reported that they used the materials as a useful "template' to guide their own material development.

A couple of members specifically commented that the EYL materials serve as a useful starting point where they can then add their own university or organizational brand so it more readily resonates with their target audience.

A couple of members said:

"We've actually modified most everything of what we do in our college that's a visual handout…And with everything we create we say we 'EYL-it' we turn EYL into a verb. We…take the template and modify it…Everything we do is EYL, from six foot by four foot posters to digital screen monitors to handouts." —University of Colorado at Boulder

"By using the (EYL) materials and template, we came up with a really attractive postcard…and I don't think we would have ever thought of approaching it that way (without EYL)." —Boston Area Girls STEM Collaborative

"We've pretty much adopted the EYL theme – it's branded at CU." —University of Colorado at Boulder

Coalition members agreed that EYL's video profiles are among EYL's most valuable resources.

Members reported that the EYL video profiles were overwhelmingly well-received by students. In addition, they commented that the videos effectively challenged stereotypes of engineering careers and changed many girls' perception of engineering.

Some members said:

"We did a survey of our girls, and before (showing the EYL videos), out of 64, only three (3) said that they were even interested in being an engineer. But by the end of it, 24 said they'd really be interested in pursuing engineering, and 50 said they would take an engineering class in high school." —PLTW

"…part of (our goal) is to demystify what engineering is and show that it is a creative pursuit…'Video profiles' is…one way to achieve that. So we really promote that on our site, to help us get to our ultimate goal…of dispelling myths about what engineering is and putting a real face on it. And we could not do that without the great production that's on EYL." —SWE

"The videos are so good…they're dead-on and so diverse. If anything, we want more. ..I think the videos are one area where (EYL) has had the most interesting impact...Sometimes it's hard to have someone come in and present things in such a way that sounds exciting, touches on everything, and is a good short, brief, lead-in.…— University of Texas at Austin

Coalition members reported that their use of EYL has had positive outcomes with academically-prepared women.

Some coalition members reported:

"(With EYL templates and designs) we literally hear comments of 'cool!' whereas we used to hand stuff out and it would go right in the trash." —University of Colorado at Boulder

"People tell me 'we like it, this is great, this is helpful.' but we don't have any data (to prove the impact)." —SWE

"In terms of the student engagement side, from what we can tell, it's hitting them, it's exciting them…we've always had a positive response from the students." —University of Texas at Austin

"We have seen an increase in the number of students coming in to CU Boulder. It's gone up a couple percent from two years ago to last year, and a couple more percentage

points from last year to this year. We're pretty sure that (EYL) had something to do with it." —University of Colorado at Boulder

"…From the research we did last fall, it appears we're having an impact with the girls who come to our website, our Facebook page, and Youtube videos in terms of how they view engineering. So in that way I think is successful…"—National Academy of Engineering

Despite the overwhelming enthusiasm for EYL expressed by coalition members, several members commented that EYL needs to reach more adult audiences, specifically parents and engineers.

One member said:

"I think that it's been incredibly productive for us in terms of grasping the attention of counselors, teachers, and students. (But) we haven't really actually hit parents as much as we plan to in the future."—University of Colorado at Boulder

Another member commented that outreach that is *not* driven by social media might be more appropriate to contact adult audiences. She said:

"A lot of the social media outreach…has been perfect for the girls…very important for the young women. I think the challenge is in outreach for the engineers, helping them understand how the EYL materials are applicable to their own programs, because most of them are not going to create new programs.…—National Academy of Engineering

Consistent with Year 2, many coalition members again commented that they were interested in combining outreach efforts and networking with other coalition members.

A couple of coalition members commented that they wanted a way to connect with other coalition members to determine how to further promote EYL and share resources. Coalition members expressed this same desire for further connectivity with other members last year.

Some members said:

"In terms of the coalition initiative, they've been very good at outreach. But, I think figuring out how there could be better communication within the group about either opportunities, or challenges, or resources that we could share on a quarterly basis would be very useful…(We'd like) more regular interaction among the coalition." —National Academy of Engineering

"An added enhancement...would be a way to share all the stuff that people are creating or doing. We started that a little bit…I've done it a couple of years now at the WEPAN national conference, and we've done a session together with EYL and the University of Colorado and UT Austin, and we put all our resources on the WEPAN knowledge center. (We want) something like that…encouraging people who have done stuff…to post (and) point people to those resources and promote others to share what they've done, so we're not exactly reinventing the wheel." —University of Texas at Austin

Many members expressed a desire to become more involved with EYL, directly contributing to the website and production.

A couple of members suggested that the EYL website could be enhanced with a higher degree of user-generated content.

For example, one member suggested that engineers in the coalition groups be included in the video profiles. Another member, whose students made videos of their own engineering-summer job experiences in a video contest inspired by the EYL profiles, suggested that they be able to contribute those videos to the EYL website.

All coalition members said that they would continue to use EYL in the future. Moreover, members generally reported that while they would continue to use EYL in the same capacity, they expressed a desire to grow and expand their involvement with EYL even further.

Some members said:

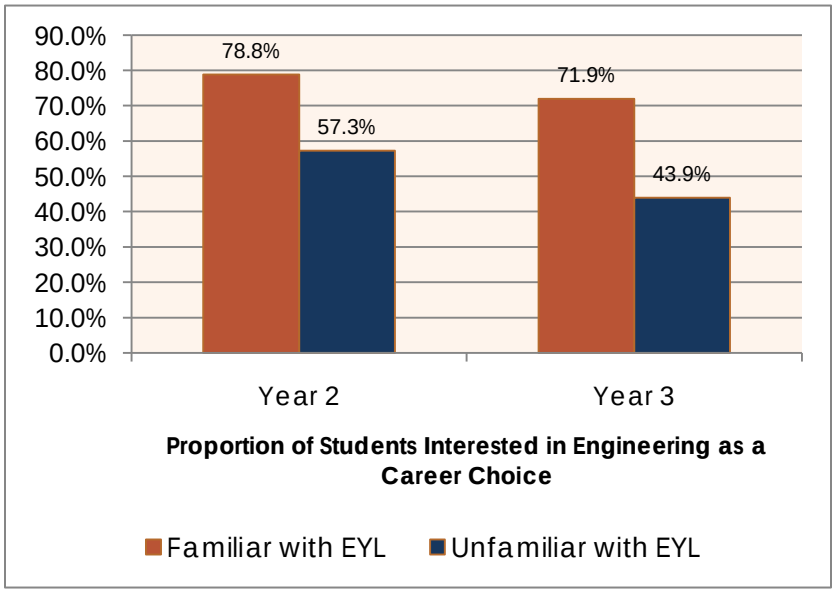
> *"If there are opportunities to use (EYL) differently in the future (we) would definitely (use it)…It's just been a great resource for (us) to use some of the research that's been done to understand why girls have been shying away from engineering, and to encourage them to use it." —Boston Area Girls STEM Collaborative*
>
> *"We always have an EYL component to what we do…and even if we change what we've currently been doing, there will always be an EYL component…."—University of Colorado at Boulder*
>
> *"I look at EYL as a resource and as a partner…So (our relationship with EYL) will change because what we're doing is going to constantly change." —SWE*
>
> *"If anything, I hope there will be more opportunities to use more (EYL) materials and get more materials out there." —University of Texas at Austin*

Summary

This study provides evidence that the EYL initiative has had a positive impact on the students, counselors, educators, engineers and outreach partners who have participated in it. EYL has helped educate participants about what the field of engineering is like, the potential impact of engineering on society, and how to prepare for a career in engineering. By providing resources for student mentors, such as educators, counselors, and engineers, and by providing resources directly to students, EYL has helped to encourage academically-prepared, female students to consider a career in engineering.

For the second year in a row, there is evidence that EYL has encouraged college-bound, high school females to consider engineering as an attractive career option and has taught them how to prepare for it.

This study found that although many students in Year 2 and 3 were interested in engineering (many more than in the baseline year of the study), students who had been exposed to EYL resources (such as the website, video profiles, posters, or career fairs) were *significantly more likely* to report that they wanted to be engineers than students in Years 2 and 3 who were unfamiliar with EYL (see Figure).



In fact, for the second year in a row, engineering was the most frequently chosen career option among *all* students, but especially for students who had been exposed to EYL.

Most of the students who viewed the EYL website indicated that the website helped them learn more about engineering (95.3% in Year 2 and 91.7% in Year 3). Most students also indicated that the website made them more interested in engineering as a career (87.9% in Year 2 and 77.8% in Year 3) and inspired them to take an engineering class in college (75.5% in Year 2 and 77.8% in Year 3).

EYL has helped female students to see engineering as an opportunity to do the kind of work they are most interested in: work that enables them to be creative and to help society.

When we asked students to tell us the most important factors in a career, students across all three years told us they wanted to (1) have fun, (2) have time for family and friends as well as work and (3) be successful, and (4) contribute to society or make a difference in people's lives. For example, roughly half of the students across all three years said they would be "very interested"

or "interested" in designing life saving medical devices for patients with heart disease and in teaching communities to make their drinking water safe.

Students who had been exposed to EYL resources were more likely to understand that engineering careers could meet their needs. For example, we found that students in Years 2 and 3 who were familiar with EYL were *significantly more likely* than those students who were unfamiliar with EYL to believe that the following skills were important to engineers:

- Imagination and creativity
- "People" skills
- Public speaking skills

Moreover, we found that students in Years 2 and 3 who were familiar with EYL were *significantly more likely* than students who were unfamiliar with EYL to believe that engineering offered them the opportunity to (1) think creatively, (2) make a difference in people's lives, and (3) work in lots of different settings.

Most students who used the EYL website indicated that the website helped them understand what they should do if they wanted to become engineers (79.2% in Year 2 and 75.0% in Year 3).

Engineers, Counselors, and Coalition Partners Reported that EYL has Helped them to Encourage Young Women to Choose Engineering

Coalition partners reported that EYL offers them a useful resource that enables them to more effectively reach out to their target audiences.

> We've actually modified most everything of what we do in our college that's a visual handout…And with everything we create we say we 'EYL-it.' We turn EYL into a verb. Everything we do is EYL, from six foot by four foot posters to digital screen monitors to handouts.
> *—Coalition Partner*

Coalition partners reported that EYL's emphasis on engineering as a philanthropic and creative field has changed the way they represent engineering careers to girls. As reported in Year 2, EYL coalition members reported that they use a wide cross-section of EYL materials to supplement or structure their own programs and enhance their own messaging. Moreover, members reported that the way EYL represented engineering has been effective in reaching their target audiences.

> We did a survey of our girls, and before (showing the EYL videos), out of 64, only three (3) said that they were even interested in being an engineer. But by the end of it, 24 said they'd really be interested in pursuing engineering, and 50 said they would take an engineering class in high school.
> *—Coalition Partner*

In terms of specific resources, members reported that the EYL video profiles were overwhelmingly well-received by students. Partners believed that the videos effectively challenged stereotypes of engineering careers and changed many girls' perception of engineering.

One partner at the university level reported an increase in female enrollment that was, in part, attributed to their use of EYL resources:

"We have seen an increase in the number of students coming in to CU Boulder. It's gone up a couple percent from two years ago to last year, and a couple more percentage points from last year to this year. We're pretty sure that (EYL) had something to do with it." —University of Colorado at Boulder

The EYL website has helped counselors and educators to learn more about engineering and how to prepare young women to pursue it.

> I am thrilled to discover this website and plan to incorporate it into my science curriculum next year. I encourage all my students to look at engineering as an option and love all the resources you have provided.
> *—High school science teacher*

Educators in Years 2 and 3 reported that they had used the EYL website, video profiles, brochures, posters and postcards with female students to educate them about the field of engineering. In Year 3, we found that respondents who were familiar with EYL reported they were *significantly more knowledgeable* about engineering career opportunities than respondents who were unfamiliar with EYL.

However, we did not observe any other significant relationships between EYL users and non-users with respect to an understanding of the academic preparation required for engineering, engineering job characteristics, or skills required. This may be due to the fact that EYL outreach in Year 3 was focused heavily on students and professional engineers, and less focused on counselors.

Respondents did report that the EYL website had a positive impact on them. We asked the respondents who used the EYL website to report how much the website changed their own level of interest in the field of engineering, if at all. More than half reported that it made them more interested in engineering (52.2% in Year 2 and 54.8% in Year 3). Most of the respondents also self-reported that the website did a good job of helping them understand what they should do to prepare high school girls to become engineers (96% in Year 2 and 97% in Year 3).

Most respondents (95.7% in Year 2 and 100% in Year 3) reported that the website did a good job of showing what life and work are like for different engineers. All respondents (100%) reported that the website helps to teach kids about engineering, that it helps kids understand that an engineering career is achievable, and that it does a successful job of introducing high school girls to young women engineers.

All respondents (100%) reported that they would visit the website again and recommend the website to others, including other counselors and students.

Engineers who used EYL resources were actively participating in outreach activities and the EYL resources helped educate them on effective messages for students.

Across both Years 2 and 3, this study found that engineers who were familiar with EYL were *significantly more likely* than engineers who were unfamiliar with EYL to report participating in (1) guest lectures at high schools, (2) career fairs, (3) engineering summer camps, and (4)

outreach programs. In Year 3, engineers who used EYL resources were also more likely than non-EYL users to participate in (1) mentoring programs, (2) career exploration days, (3) Engineering Week, (4) school events, and (5) Girl Scouts.

In Year 3, engineers who were familiar with EYL were *significantly more likely* believe that one of the most important aspects of engineering is that "engineers make a difference in the world." Engineers who were *familiar* with EYL were also significantly more likely to downplay the following career aspects as less important:

- Studying to be an engineer is very difficult.
- Math and science are extremely important to be successful in engineering.
- Engineering is a challenging and demanding field.

Engineers who were familiar with EYL prior to completing the survey were significantly more likely to believe that there were barriers to women entering the engineering profession than engineers who were unfamiliar with EYL. Engineers in Years 2 and 3 who were familiar with EYL were also significantly more likely to believe that young women were unaware of what engineers do than engineers who were unfamiliar with EYL. Engineers in Year 2 familiar with EYL were more likely to believe that there is a lack of visible role models for young women than engineers who were unfamiliar with EYL. In Year 3, engineers who were familiar with EYL were more likely to believe that college counselors do not do enough to encourage women to enter the industry than were engineers who were unfamiliar with EYL.

In Year 2, engineers who were familiar with EYL were significantly more likely than engineers who were unfamiliar with EYL to report that "engineering is rewarding." In Year 3, engineers familiar with EYL were more likely than other engineers to report that engineering offers variety in terms of career tracks.

Engineers reported that the EYL website is realistic, useful, and educational.

Among the engineers who reviewed the website, almost all of the engineers (96.1% in Year 2 and 100% in Year 3) reported that the website did a good job of showing what life and work were like for engineers. Most (88.3% in Year 2 and 97.9% in Year 3) also reported that the website helped them to feel more comfortable helping to prepare high school girls for becoming engineers.

> EYL is fabulous. If everyone used this in their school curriculum and outreach programs, we'd have more girls considering engineering as a career.
> *—Professional Engineer*

Almost all of the engineers (97.1% in Year 2 and 100% in Year 3) reported that the website helped kids learn about engineering and did a successful job of introducing high school girls to female engineers. All of the engineers (100%) reported that the website helped kids understand that an engineering career is achievable.

All of engineers (100%) indicated that they would recommend the website to a student who is interested in learning more about engineering. Almost all of the engineers (97.1% in Year 2 and 100% in Year 3) reported that they would recommend the website to a colleague.

Opportunities Remain to Address the Need for More Engineering Students

Although the current funding period for EYL has ended, there appear to be additional opportunities for EYL, or a program like EYL, to address the need for more US-based talent in the field of engineering. [24,25,26,27]

The majority of the counselors/educators across all three years of data collection reported that they perceived both educational and non-educational barriers to entry for women into the profession. Most counselors/educators reported that educational factors were a barrier to entry into the field of engineering for women, especially the lack of engineering classes and program offerings in many schools and the lack of encouragement for girls to take the prerequisite classes. More than one-third of the counselors "strongly agreed" or "agreed" that boys were generally more encouraged to pursue engineering than girls. More than half of the counselors reported that there were several non-educational barriers to women entering the field of engineering, including a lack of female role models, women being unaware of what engineers do, the masculine image associated with engineering, and aversion to working in a male-dominated environment.

The majority of engineers also reported that there were barriers that prevented women from entering into engineering. The most commonly reported barrier was young women's lack of familiarity with the engineering industry. Other key barriers included: a lack of visible role models, the perception of having to work in a male-dominated environment and being the "lone female," and the masculine image of engineering. In fact, we asked the engineers whether they had any male or female engineers as role models when they were in school or starting their career. Very few respondents reported having a female role engineer as a role model (14.5% in Year 1, 21.9% in Year 2, 17.6% in Year 3). Meanwhile, 66% of respondents in Years 1 and 2 and 63% of respondents in Year 3 reported that they had a male engineer as a role model.

Thus, there remain opportunities for programs based on the EYL model to continue to reach out and educate students, counselors, educators, and engineers about the field.

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