
Extraordinary Women Engineers

**Final Report
April 2005**

Table of Contents

2	Executive Summary
5	Introduction
5	Target Audiences
6	Methodology
7	Research Goals
7	Detailed Target Audience Information
9	Detailed Findings
18	Key Findings
19	Strategic Recommendations
Survey Instruments	
20	Discussion Guide for Online Focus Groups
22	Future Careers Survey
25	Teacher and Counselor Survey
28	Engineering Student Survey
30	Engineer Survey
32	Messaging Survey—Phase 2
39	Credits

Executive Summary

The Extraordinary Women Engineers project (EWEP) is a national initiative to encourage girls to consider pursuing a degree and subsequent career in engineering. The project is led by a coalition of the country's engineering associations and the American Association of Engineering Societies (AAES), the American Society of Civil Engineers (ASCE), and WGBH Educational Foundation.

Formed in Spring 2004, the coalition began with a review of the question, "Why are academically prepared girls not considering or enrolling in engineering degree programs?" We know the issue is not one of ability or preparation. Researchers Huang, Taddese, and Walter found that girls are taking high school science and math courses at approximately the same rate as boys: 94% of girls and 91% of boys take biology, 64% of girls and 57% of boys take chemistry, 26% of girls and 32% of boys take physics, and 64% of girls and 60% of boys take algebra II. We believe that the problem is one of perception. Girls and the people who influence them—teachers, school counselors, parents, peers, and the media—do not understand what a career in engineering looks like and therefore don't consider it as a career option.

To test this assumption, WGBH conducted qualitative consumer research with high school girls, science and math teachers, and school counselors; male and female college-level engineering students; and engineers. From June 2004 to January 2005, we hosted four in-person focus groups, two online focus groups, and five online surveys that served as an alternative to traditional in-person focus groups. (This methodology was used to determine general attitudes and behaviors and is not subject to formulaic analysis.)

Research Goals

- Gauge high school girls level of interest in and awareness of careers in the engineering field
- Assess general career motivators and barriers toward the engineering field
- Evaluate current messages being put forward to the target audience by the engineering community
- Explore messaging opportunities for increasing enrollment in the engineering field

Key Findings

What do high school girls think about engineering?

High school girls believe engineering is for people who love both math and science. They do not have an understanding of what engineering is. They do not show an interest in the field nor do they think it is “for them.”

Is there a gender divide in engineering?

The common understanding among all audiences is that engineering is perceived to be a man’s profession and there is little to no encouragement for girls to consider engineering.

What are career motivators for high school girls?

Professional interests for high school girls hinge upon relevance. Relevance incorporates that a job is rewarding, and it suggests that the profession is for someone “like me.” Girls want their job to be enjoyable, have a good working environment, make a difference, offer a good salary, and be flexible.

Who are the career influencers for high school girls?

Parents, peers, educators, and the media are reported to be key influencers and resources for information gathering.

What do the career influencers say about engineering?

Career influencers, including educators, are not familiar with how to guide students toward engineering. The positive stories about engineering are not being told to this audience.

What messages is the engineering community sending to high school students?

Current engineering messages portray engineering as challenging and stress the importance of superior math and science abilities. These messages are not relevant to this audience. Messages do not include the benefits and rewards of being an engineer.

What messages about engineering will resonate with high school students?

High school girls react positively to personal and informational stories that tell more about the engineering lifestyle. They are interested in learning how engineering aligns with their career motivators—enjoyable, good working environment, making a difference, good income, and flexibility. The most effective messages use examples that contain multiple career motivators.

Strategic Recommendations

To achieve the project's goal of increasing the number of academically prepared girls who pursue an education and subsequent career in engineering, we recommend **a fundamental shift in the way engineering is portrayed**. Rather than focusing on the process and challenges of becoming an engineer, we recommend a focus on the benefits and rewards of being an engineer as they relate to the career motivators identified by the girls in this assessment.

To do this, the EWEP coalition recommends the following actions:

- Facilitate a dialogue within the engineering community on the need to redefine engineering as a desirable career option for academically prepared high school girls.
- Develop and test messages that illustrate engineering as a career that complements and supports community interests, family interests, and self-interests.
- Create materials using these tested messages to promote engineering to high school girls
- Create training opportunities and resources engineers can use to promote engineering education and careers to girls, their parents, and educators.
- Create training opportunities and resources school counselors and teachers can use to promote engineering education and careers to girls and their parents.

Introduction

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To test this assumption, WGBH conducted qualitative consumer research with high school girls, science and math teachers, and school counselors; male and female college-level engineering students; and engineers. From June 2004 to January 2005, we hosted four in-person focus groups, two online focus groups, and five online surveys that served as an alternative to traditional in-person focus groups. (This methodology was used to determine general attitudes and behaviors and is not subject to formulaic analysis.)

Target Audiences

Primary

National sample of high school girls (ages 14–17) who are “academically prepared” for college-level STEM courses

Secondary

General high school girls
High school teachers and school counselors
College students majoring in engineering
Engineering professionals
Society of Women Engineers (SWE) members

¹ Huang, Gary, Nebiyu Taddese, and Elizabeth Walter (2000). *Entry and persistence of women and minorities in college science and engineering education* (NCES 2000-061). Washington, DC: U.S. Government Printing Office. As cited by Campbell, Patricia, and Beatriz Chu Clewell (2002). Taking Stock: Where We've Been, Where We Are, Where We're Going. *Journal of Women and Minorities in Science and Engineering*, vol. 8, p. 259.

Methodology

June 2004–January 2005

We employed a number of methods to reach our target audiences:

In-Person Focus Groups

In June, WGBH staff hosted two focus groups with school counselors at the national meeting of the American School Counselors Association (ASCA). In October, we hosted two more focus groups at the annual meeting of the National Association for College Admissions Counseling (NACAC). Forty-five school counselors participated in the four focus groups.

Online Focus Groups

We worked with a private firm to professionally recruit high school girls to participate in a two-phase qualitative research project. Phase 1 consisted of online focus groups with 85 girls and phase 2 was a messaging survey with 74 girls (made up of a subset of the girls in phase 1). An online focus group is an affordable alternative to the traditional in-person focus group. This research tool allows chat-like discussion with a broader national sample. The online environment is particularly effective for a teen audience as it elicits honest responses, uninfluenced by peer pressure or group dominance.

Online Surveys

Participants for the five online surveys were recruited via the project coalition. E-mail invitations were sent out in November 2004. We received a total of 4,376 respondents to five surveys. The online survey was used as a qualitative tool to gather feedback from the secondary audiences. With the use of mostly open-ended questions, the data collected from the online surveys is very much like feedback received from a series of in-depth interviews.

Target Audience	Methodology	Number of Respondents
High school girls	Online Focus Group	85 for Phase 1
	Follow-Up Online Survey	74 for Phase 2 (from the original 85 respondents)
	Online Survey	165
Teachers/school counselors	Online Survey	110
	In-Person Focus Group	45
College engineering students	Online Survey	1,750
Engineering professionals	Online Survey	2,268
SWE members	Online Survey	83
Total		4,506

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Detailed Target Audience Information

High School Girls

Online Focus Groups

The online focus group was a two-phased qualitative research project with professionally recruited high school girls. Phase 1 consisted of an online focus group with 85 girls designed to gauge their level of awareness of engineering and assess career motivators. Phase 2 was made up of a 74-member subset of girls from phase 1 and explored messaging opportunities about engineering.

The girls who participated in the online focus groups were between the ages of 14 and 17 (age breakdown: 14-year-olds—13%; 15-year-olds—24%; 16-year-olds—50%; 17-year-olds—13%). They were selected from a national sample of female students, who represented a diverse mix of ethnic backgrounds. Twenty-seven states were represented, including New York, Georgia, Florida, Kentucky, California, Minnesota, Ohio, and Pennsylvania. These girls were selected to participate because they were taking competitive and challenging courses, including algebra, pre-calculus, chemistry, and biology. The most popular courses among the group were English, foreign languages, math, and then science. Many attribute their choice of favorite class to their teachers. Only one-third of the girls in this group knew someone who was an engineer or an engineering student, and these members of the engineering community were primarily male (e.g., dads and uncles).

Online Survey

This sample consisted of 165 high school girls from grades 9–12 (grade-level breakdown: 9th grade—16%; 10th grade—18%; 11th grade—44%; 12th grade—22%). Fourteen states are represented in this sample, including California, Massachusetts, New York, New Jersey, Pennsylvania, Virginia, Texas, and Washington. These girls were taking challenging courseloads with AP English, AP US history, AP calculus, AP biology, AP physics, and advanced courses in language arts. Their favorite courses included English/literature, history, foreign languages, and music. Compared with the girls in the online focus group, a greater percentage of respondents (38%) reported having a parent/guardian who works or has worked in a science-related field and 52% reported knowing a friend or family member employed as an engineer, or who is majoring in engineering.

Teachers/School Counselors

Online Survey

This group had 110 respondents. It comprised 64 teachers and 46 school counselors. Two-thirds of the group worked at public high schools, with the remaining one-third working in private schools. The school counselors work primarily as college advisors. The majority of the teachers represented were math- or science-focused (e.g., biology, chemistry, computer science, physics, math).

In-Person Focus Groups

This group was made up of 45 school counselors from across the U.S. Nearly half of the counselors (21) worked in suburban schools, with the remainder being fairly split between urban (12) and rural (10) schools. These counselors worked at schools of varying sizes with the smallest school enrolling 20 students and the largest enrolling 2,500. Like the counselors from the online survey group, they work primarily as college advisors.

Engineering Students

Online Survey

1,750 engineering students responded to the online survey. Eighty-three percent of the respondents were female. The sample represented an even split of upperclassmen and lowerclassmen. Like the engineers, 55% reported having parents who are engineers with the majority indicating that it was their father.

Engineers

Online Survey

2,268 engineers responded to the online survey. Fifty-nine percent were female and 41% were male. Fifty-six percent had been employed as an engineer for longer than 10 years and 55% reported having parents who are/were engineers (the majority reported a male parent).

Society of Women Engineers

Online Survey

In mid-December 2004, an e-mail was sent to the SWE membership about the online survey. 83 female engineers responded to the survey. Forty percent had been employed as an engineer for longer than 10 years, 32% for 6–10 years, 16% for 2–5 years, 12% less than 1 year. Forty-four percent reported having parents who are also engineers (the majority reported a male parent).

Detailed Findings

What do high school girls think about engineering?

High school girls believe engineering is for people who love both math and science. They do not have an understanding of what engineering is. They do not show an interest in the field nor do they think it is “for them.”

To gauge the level of interest in engineering and understand what high school girls think about engineering, we asked them a series of questions:

What are the first two words that come to mind when you hear “engineer”?

Girls described engineering with the following list of words: math and science, smart, really smart, problem-solving, design, nerdy, building, hard, complex, men, cars, engines, don’t know, trains, bridges, Dilbert, math, too difficult, science, machines, boring, boys.

What type of person or classmate do you think is most likely to become an engineer?

The girls told us that their general understanding is that engineers are people who love *both* math and science and are academic achievers and problem solvers.

- *“Someone who excels in math and science. Likes working out problems and working with other people. Someone who is motivated, dedicated, and who doesn’t mind sitting in a cubical all day.”*
- *“I believe it would have to be someone who enjoys mathematical situations and loves a good challenge.”*

How interested are you in becoming an engineer? Why or why not?

Less than 10% of the full sample of high school girls report being interested in becoming an engineer. Nearly 70% of the online survey sample actively disagree that they’re interested in the field. Some students found it a deterrence that they needed to be good in both math and science, especially when they were interested in one subject but not the other. Nearly 10% said they disliked science and another 10% said they disliked math. A quarter of respondents admitted that they did not know enough about engineering to be interested, of which a few said they might consider it if they did.

From the educator perspective

When we asked teachers and school counselors what their students think about engineering, they reported that it is not a popular or well-understood profession and may not be appropriate except for unique students. One-third of the respondents suggested

that less than 5% of their students are interested in engineering as a profession. Many feel that this results from a fundamental lack of awareness. Counselors reported that when they have recommended engineering to students who have been identified as good problem solvers by their teachers, the students are shocked, as they don't think of themselves as nerds.

Roughly 50% report that their schools offer classes related to engineering. The robotics classes are very popular with students and counselors tell of students fighting to get into them. But students don't think of robotics as engineering. Teachers and school counselors also believe that the type of students who are interested in engineering tend to be those who are on the honors track and those who are heavily involved with a math and science curriculum—primarily males.

- *“Strong math and science students.”*
- *“Students who are in advanced placement science classes are most likely to be interested.”*
- *“Top 5% of the class, and those whose family members are engineers.”*

Is there a gender divide in engineering?

The common understanding among all audiences is that engineering is perceived to be a man's profession and there is little to no encouragement for girls to consider engineering.

What if I told you that national statistics show that girls are not as interested in engineering as boys, why do you think this is true?

High School Girls

Most girls were neither surprised nor dismayed by this statement. In fact, many report that girls and boys have different interests. Typical comments included that boys are more interested in technology and girls are more interested in English and more “feminine professions” (this is a direct quote and we are unsure of the exact meaning). Other reasons the girls put forth for this disparity are that engineering is perceived to be more masculine, with building seeming to be a “man's job.” They think of machines and getting dirty. Many attributed it to society, stating girls are not as encouraged, not exposed at an early age.

- *“Engineering is something that is not introduced to girls as something we can do. Most girls think of it as a boy's job.”*
- *“I don't think girls believe they can do it because it involves too much math and science, fields that boys usually dominate in the classroom. It has historically been a man's major and not many women are involved in that field.”*

Some respondents were optimistic, and while they believed the statistics may be true, they can be changed.

- *“I think this is true because girls aren’t encouraged to pursue careers in engineering. It’s another stereotype of American society today. As time progresses, I believe the statistics will even out.”*
- *“I think it’s true, because for as little as I know, I do know this—ever since engineering came around, it has always been a male-dominated career area. I think it’s just one of those careers that hasn’t truly come out of the ‘male / female’ division in careers. But, hey, who knows, maybe that’s going to change sometime soon!”*

Educators

Like their students, teachers and school counselors perceive a difference between the motivations and interests of girls and boys. And they recognize that the discrepancy particularly applies to the field of engineering/math and science. Their thoughts on why this is so include: females are more interested in people, socialization, and family; there is little knowledge or encouragement for women in the engineering field; there is little early exposure (pre-high school); and there are no role models.

- *“Males are still math- and science-oriented and females are more people / helping-oriented.”*
- *“Very few females go into engineering. They do not see the career being very glamorous.”*

Engineers and Engineering Students

When asked about the gender divide in engineering, the engineers and engineering students also agree that an imbalance exists in perceptions towards engineering. Reasons given for this divide include: strong stereotypes that support engineering as a male profession; a lack of mentors and role models for women in the field of engineering; engineering is not considered mainstream or relevant, particularly for women; and most women have no idea what an engineer actually is, or the type of work involved.

- *“Engineers are often stereotyped as geeks. This, coupled with the fact that some girls are discouraged from pursuing math and science, often results in an unfavorable perception created at a very young age.”*
- *“Women have little idea of what engineers do and most fictitious ones, e.g., in the movies, are nerdy males designing weaponry.”*
- *“They do not understand how engineering helps people. They don’t have any female role models so it does not seem natural for them to go into engineering. The women in their lives are probably not engineers nor are they knowledgeable about what type of works it involves. Young girls get a lot of peer pressure not to be good in math and science, so they definitely don’t want a career in it.”*

More specifically, we asked female engineers, *“What is the most discouraging thing about being an engineer?”* The most discouraging aspect of their jobs for the clear major-

ity of these respondents is the lack of support, lack of respect, constant loneliness, and the glass ceiling that they experience as women in a man's world.

- *“As a woman, people don't think you can do the job as well as a man.”*
- *“It's hard to believe the level of gender discrimination that still exists.”*
- *“There seems to be less flexibility for those women that want to have a family than in other industries.”*
- *“It is a field where women are still a minority, and it is a challenge.”*

What are career motivators for high school girls?

Professional interests for high school girls hinge upon relevance. Relevance incorporates that a job is rewarding, and it suggests that the profession is for someone “like me.” Girls want their future job to be enjoyable, have a good working environment, make a difference, offer a good salary, and be flexible.

I want you to imagine your future for a minute. What do you think is the ideal career for you?

Many were undecided about their future careers. But the most popular fields/industries were medicine (particularly doctor, pediatrician, veterinarian), business, entertainment, and education. Only 3 out of 85 girls in the online focus group (4%) said they wanted to become an engineer (mechanical engineer, computer engineer, biomedical/environmental engineer).

- *“I want to be in medical research. I love science and I love people, and if I could find a cure or help someone fight off disease, I'd be so happy.”*
- *“I'm interested in business because it's fun to travel for your job, good atmosphere, chance to make it big. It just seems like something that I could imagine myself doing.”*

What are the most important things for you to consider when deciding on your future ideal job?

The following factors are ranked in order of importance.

Enjoyable—Students want to enjoy what they do day in and day out.

“How happy I will be—what's the point of doing anything you don't like?”

Good working environment—Getting along with co-workers, location, fun-factor is a big priority.

“Working environment is important. A friendly working environment always makes working easier!”

Makes a difference—Students want to know that what they do matters.

“That I would make a difference in some way, you know, make my mark on the world.”

Good Income—These students are practical and money is a big factor. There were several mentions of financial security and stability.

“As shallow as it sounds, money is the one thing I have to consider when I’m choosing a job. I’m not going to do something that I know can’t help me pay bills.”

Flexibility—Students are looking for a job that allows time for family, hobbies, and travel.

“My career can’t consume all of my time... I need free time to do a lot of other things I want to accomplish before I die and when I have a family, I need time to spend with them.”

Do you have an example of someone you know who has a job with those ideal traits?

Most students do not personally know people who have jobs with these ideal traits. Their exposure to the working world is limited to their parents or their teachers. Many mentioned teachers as people who seem to love their jobs. Some mentioned examples of fictional characters with ideal jobs on TV.

Are you already thinking about college? If so, what colleges/universities are you considering?

College is on all their minds, from freshmen to seniors. Factors for deciding colleges include location (near or far), prestige of school, and relevance to potential major/career.

Have you thought about what you want to major in or study in college? What academic field?

Most respondents are not as certain about choosing a major. They want it to relate to their current interests and future aspirations.

Are you planning to take classes in high school that relate to this field of interest?

Most of the girls’ current schedules are limited by required curriculum. Classes specific to their fields of interest are rare. Others view everything as college prep.

Who are the career influencers for high school girls?

Parents, peers, educators, and the media are reported to be key influencers and resources for information gathering.

High school girls in both the focus group and survey were asked, “*Who do you talk to when you want advice about career choices?*” Most girls indicated that their parents are influential for listening to them and guiding them about future careers. Friends and peers are a close second to parents. Teachers tie with siblings for third. School counselors and professionals are the fourth most cited group. (For this question, girls in the survey were asked to select all that apply from the following list: teacher, parent/

guardian, guidance counselor, older sister/brother/relative, friends/peers, a professional in that field, and other.)

The science and math teachers and school counselors surveyed agree with the girls. While three-fourths feel that they actively impact student decisions regarding both college and future careers, parents are deemed most important. In addition, respondents feel they have a greater influence on their students more immediate college decisions rather than their career paths.

- *“Many parents still influence students.”*
- *“Many students are highly influenced by their family history and education attained by their parents and siblings.”*

What do the career influencers say about engineering?

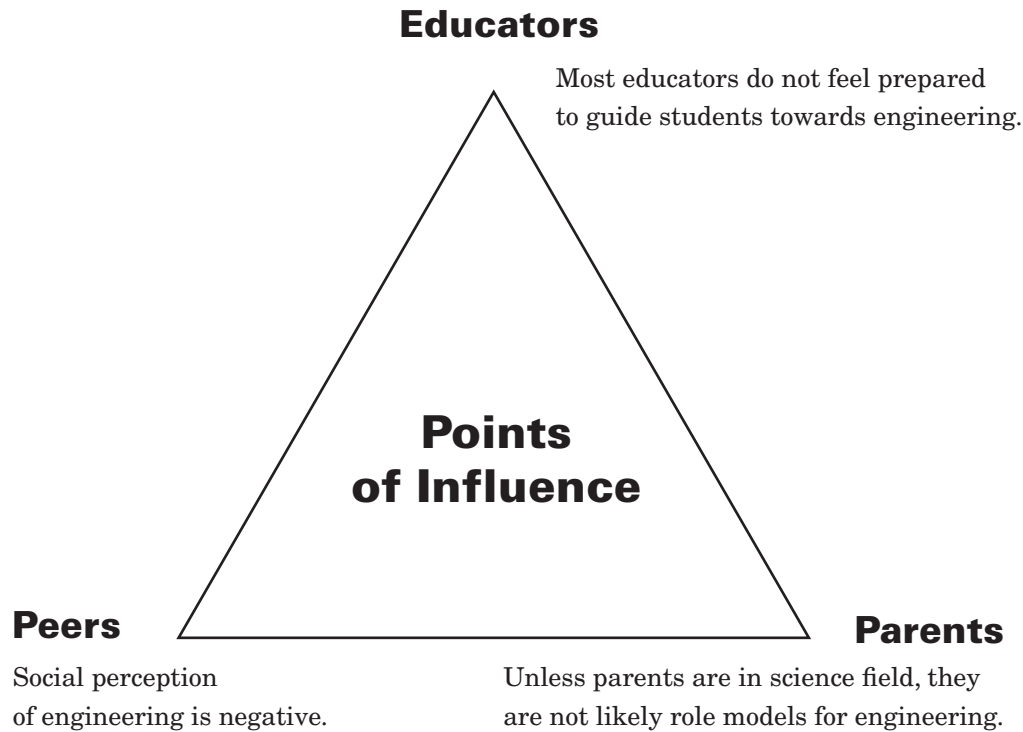
Career influencers, including educators, are not familiar with how to guide students toward engineering. The positive stories about engineering are not being told to this audience.

Peers are strongly influential for high school girls, so we asked, *“What would your friends say if you suggested that you were planning to become an engineer?”* The girls thought their friends would be confused and surprised at first, but that they would be supportive of this decision. A few respondents thought their friends might think it was nerdy or geeky to be an engineer.

- *“They would probably laugh, call me a nerd and then be like nah it’s cool, make the money.”*
- *“It seems kind of like a nerdy thing to be interested in, but I’m sure that my peers would think that it was a noble thing.”*

In our survey with educators, we found that many teachers and counselors do not feel prepared to help their students explore the engineering profession, with one quarter of respondents reporting that they don’t know enough to help students learn more about engineering. When asked how students can learn more about engineering, the respondents suggested that students should go “online” or check out local university departments.

- *“Search the Internet, talk to people in the field.”*
- *“I suggest they go to a university’s engineering department Web site and explore.”*



What messages is the engineering community sending to high school students?

Current engineering messages portray engineering as challenging and stress the importance of superior math and science abilities. These messages are not relevant for the high school audience. Messages do not include the benefits and rewards of being an engineer.

What are the two most rewarding things about being an engineer?

Engineers and engineering students enjoy their jobs for the following reasons: involvement from start to finish provides satisfaction; they like having an impact; it is challenging; there are many interesting and diverse problems to solve which often require creative thinking; and financial benefits provide a sense of success and comfort with their profession.

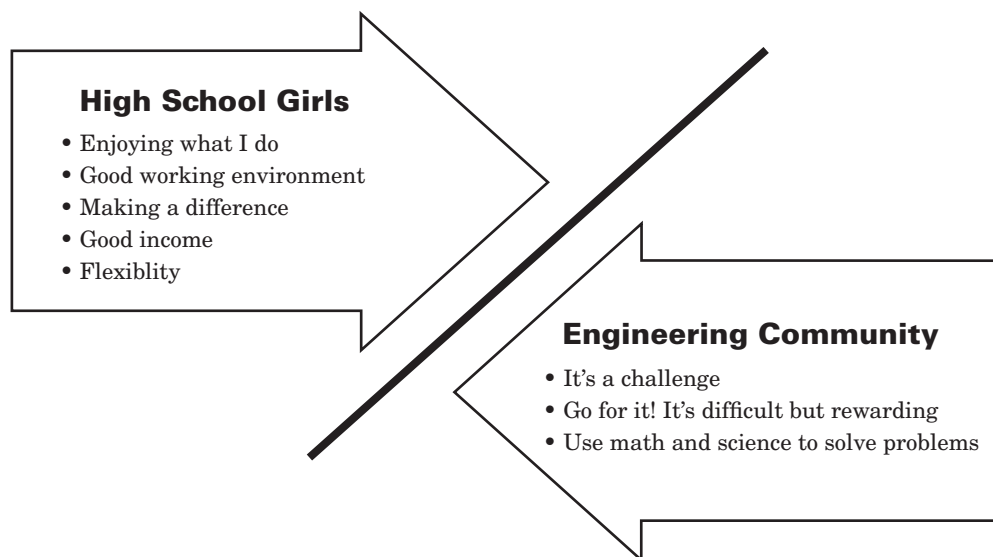
- *“Being involved in projects from conception to completion. Public reaction to the finished product.”*
- *“Ability to participate in real-world problem solving and making a difference.”*
- *“It’s challenging and demands you to be creative.”*
- *“It provides for a reasonable living. Being an engineer garners a certain amount of respect.”*

When we asked engineers and engineering students, *“If you were to give advice to a young person (high school student) interested in engineering, what would you tell them?”*, the majority of respondents would tell them to excel in both math and science because the payoff is a career full of compelling opportunities to work with exciting challenges. They would also tell them it’s a challenge, but go for it anyway. Many respondents would suggest trying it, in spite of how difficult it may be, and in spite of the “hype” surrounding how challenging it is.

- *“Math and science! Work to excel in both disciplines!”*
- *“Engineering is difficult and stressful, but you will realize that you’re gaining that much more knowledge and experience.”*
- *“They should be working hard in math and science in order to make the switch from high school to college easier.”*
- *“Engineering is one of the toughest majors in college; you need to have confidence to get through it.”*
- *“It’s not easy—but if you’re the type who when faced with a problem some would call impossible is even more driven to move mountains to find a solution, then you might have it in you to be an engineer.”*

The Disconnect

Current messaging about engineering is not aligned with key motivators for students. Neither the emphasis on “curriculum” nor the notion of “a challenge” is relevant to high school girls.



What messages about engineering will resonate with high school girls?

High school girls react positively to personal and informational stories that tell more about the engineering lifestyle. They are interested in learning how engineering aligns with their career motivators—enjoyable, good working environment, making a difference, good income, and flexibility. The most effective messages used examples that contained multiple career motivators.

To explore messaging opportunities for increasing enrollment in the engineering field, messaging examples were created based on high school girls' top career motivators and tested through an online survey.

The messaging examples that resonated with high school girls segmented into two key areas:

- Informational stories that told them more about what the engineering profession entails
- Positive personal stories that related engineering to the lifestyle that they are hoping to obtain

We asked the high school girls to imagine, *“As head of advertising, trying to tell a positive story about why people like you should become engineers, what would you say or do?”*

As this audience is not well versed in what an engineer does, high school girls said they would like messages with more information about what the real-life engineering job entails. The most effective messages about engineering for this audience are stories of current engineers, examples of what convinced them to choose their profession.

- *“I would definitely show the different types of things engineers do, the salary they make, the colleges that some engineers attended. I'd have some engineers do a commercial, telling their story. It's more personal and something people can relate to or aspire to!”*
- *“I would have real engineers on the campaign, giving their reasons for being an engineer. I would also want engineers to share their success stories.”*

Students also reacted favorably to human-interest stories connecting an engineer's job with people and their surroundings.

- *“I would share more stories of how people's lives have been affected by engineers.”*
- *“How engineering is not just about drawing and cars... It can be about social issues, and third-world countries becoming better and their citizens happier.”*

When we presented the girls with a chart comparing engineers' starting salaries to teachers, journalists, and nurses, they did not find this message to be surprising or compelling enough. They are already aware that engineering is a profitable career.

High school girls want to know how this profession matches up to their top career motivators. They welcomed messages about engineering that focused on the fun factor, interesting work locations, and the monetary benefits of being an engineer. The most effective messages used examples that contained multiple career motivators.

- *“Talk about the hands-on fun, that it’s not sitting in a cubicle all day, but it’s traveling the world, making a difference, seeing your imaginations and creations come to life before your eyes.”*
- *“Not only do I get to be creative and design new things, but I get to do it in a way that makes people’s lives better.”*
- *“Engineers not only make a lot of money, but they contribute to the well-being of the human race.”*

Key Findings

What do high school girls think about engineering?

High school girls believe engineering is for people who love both math and science. They do not have an understanding of what engineering is. They do not show an interest in the field nor do they think it is “for them.”

Is there a gender divide in engineering?

The common understanding among all audiences is that engineering is perceived to be a man’s profession and there is little to no encouragement for girls to consider engineering.

What are career motivators for high school girls?

Professional interests for high school girls hinge upon relevance. Relevance incorporates that a job is rewarding, and it suggests that the profession is for someone “like me.” Girls want their job to be enjoyable, have a good working environment, make a difference, offer a good salary, and be flexible.

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Current engineering messages portray engineering as challenging and stress the importance of superior math and science abilities. These messages are not relevant for this audience. Messages do not include the benefits and rewards of being an engineer.

What messages about engineering will resonate with high school students?

High school girls react positively to personal and informational stories that tell more about the engineering lifestyle. They are interested in learning how engineering aligns with their career motivators—enjoyable, good working environment, making a difference, income, and flexibility. The most effective messages used examples that contained multiple career motivators.

Strategic Recommendations

To achieve the EWEP project's goal of increasing the number of academically prepared girls who pursue an education and subsequent career in engineering, we recommend a **fundamental shift in the way engineering is portrayed**. Rather than focusing on the process and challenges of becoming an engineer, we recommend a focus on the benefits and rewards of being an engineer as they relate to the career motivators identified by the girls in this assessment.

To do this, the EWEP coalition recommends the following actions:

- Facilitate a dialogue within the engineering community on the need to redefine engineering as a desirable career option for academically prepared high school girls.
- Develop and test messages that illustrate engineering as a career that complements and supports community interests, family interests, and self-interests.
- Create materials using these tested messages to promote engineering to high school girls.
- Create training opportunities and resources engineers can use to promote engineering education and careers to girls, their parents, and educators.
- Create training opportunities and resources school counselors and teachers can use to promote engineering education and careers to girls and their parents.

Discussion Guide for Online Focus Groups

Topic: Women in Engineering

Objectives

1. To gauge level of awareness of careers in the engineering field among teen girls
2. To assess motivators and barriers towards the engineering field
3. To determine messaging opportunities for increasing enrollment in the engineering field

Introduction/Ice Breakers

Upfront explanation of online focus group. Emphasis on open and honest dialogue.

- Please introduce yourself. Tell me your first name, grade, and where you're from.
- What courses are you currently taking in school? Please list all and tell me which is your favorite.

Perception of the Future and Professional Priorities

Understand motivations behind professional inclination.

- I want you to imagine your future for a minute. What do you think is the ideal career for you? Why?
- What are the top three most important things for you to consider when deciding on your future ideal job? Why do you say that?
- Do you have an example of someone you know who has a job with those ideal traits? What do they do?
- Who do you talk to when you want advice about career choices?

General Professional Track and Perceived Relevance of High School

Gauge type of professional motivation.

- Are you already thinking about college? If so, what colleges/universities are you considering? What made you consider these schools?
- Have you thought about what you want to major in or study at college? What academic field? What made you consider this field to study?
- Are you planning to take classes in high school that relate to this field of interest? Why/why not?
- Are you familiar with anyone who majored in this field or is currently active in a related professional field?

Engineering Relevance and Awareness

Gut reactions to engineering.

- Let's talk more specifically about one professional field—engineering. What are the first two words that come to mind when you hear “engineer”? Why do you say that?
- Do you know of anyone (friend or family) employed as an engineer or majoring in engineering?
- Are you familiar with what an engineer does? If so, please share examples.
- Are there any programs or classes at your school that have introduced or explored the field of engineering? Which ones and what have you done in them?
- What type of person or classmate do you think is most likely to become an engineer?
- How interested are you in becoming an engineer? Why or why not?

Engineering Communication

Possibilities for messaging.

- What would make the field of engineering desirable for you?
- What do you think your friends would say if you suggested that you were planning to become an engineer, or what have they said if already interested?
- What if I told you that national statistics show that girls are not as interested in engineering as boys, why do you think this is true?
- If you needed/wanted to find out more about engineering, what would you do?

Future Careers Survey

Thank you for participating in our survey. We would appreciate your honest and thorough feedback to better understand the future aspirations of high school students.

- 1) First, please complete the following information:

Name of School: _____

City/Town: _____

State: _____

- 2) What grade are you in?

- 3) What type of school do you currently attend?

- 4) What courses are you currently taking in school? Please list all and tell us which is your favorite.

- 5) Please rate the following statements on a scale of 1 to 5:

1	2	3	4	5
Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree

I am already thinking about college—the schools I want to attend and the majors that I am interested in.

1 2 3 4 5

My high school courses are preparing me for the academic field I want to study in college.

1 2 3 4 5

I have a strong idea of what I want to do as a career.

1 2 3 4 5

I am interested in becoming an engineer.

- 1 2 3 4 5

Please explain:

12) Do you have a parent/guardian who works or has worked in a science-related field?

13) Do you know of anyone (friend or family) employed as an engineer or majoring in engineering?

- Yes No

If yes, who?

14) Are there any programs or classes at your school that have introduced or explored the field of engineering?

- Yes No

If yes, which ones and what have you done in them?

15) What if I told you that national statistics show that girls are not as interested in engineering as boys, why do you think this is true?

Teacher and Counselor Survey

Thank you for participating in our survey. We welcome your honest and thorough feedback to better understand high school students and their career aspirations.

- 1) First, please complete the following information:

Name of School: _____

City/Town: _____

State: _____

- 2) Are you a teacher or a guidance/career counselor?

- 3) At what type of school do you currently teach/counsel?

- 4) What grade levels do you currently teach/counsel? (Select all that apply)

7th grade

8th grade

9th grade

10th grade

11th grade

12th grade

- 5) Please answer the following, if applicable:

a. If you are a teacher, what academic subject do you teach?

b. If you are a counselor, do you have an area of specialty?

c. How long have you been working in this subject/area of expertise?

- 6) Please rate the following statements on a scale of 1 to 5:

1	2	3	4	5
Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree

I play an influential role in helping students plan for college.

1 2 3 4 5

I play an influential role in helping students plan for their future careers.

- 1 2 3 4 5

7) What are the most popular careers that students are considering? Why do you think that is?

8) Now, thinking only about those students who are considering the college track, what is the most popular potential major? Why do you think that is?

9) Do you see a discrepancy between the career/major pursuits of male and female students?

- Yes No

If so, what are they and why do you think they exist?

10) What are the most important influences on the professional considerations of your students? Please pick one and tell us about it.

11) Is there a difference between male and female students when it comes to the influences that determine their professional and college major considerations?

- Yes No

If so, what are the differences and why do you think they exist?

12) Let's talk more specifically about one professional field—engineering. What percentage of your students are interested in pursuing engineering as a major or future professional field?

13) Please rate the following statements on a scale of 1 to 5:

1	2	3	4	5
Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree

My students are familiar with what an engineer does.

1 2 3 4 5

I know enough about engineering to help students decide if they should become engineers.

1 2 3 4 5

14) Are there any programs or classes at your school that have introduced or explored the field of engineering?

Yes No

If yes, how are they perceived by students? Who is enrolling in these programs?

15) In your opinion, what types of students are most likely to be interested in engineering, and is there a gender discrepancy?

16) What if I told you that national statistics show that girls are not as interested in engineering as boys, why do you think this is true?

17) What would make the field of engineering desirable for your students—and the female students in particular?

18) If your students need/want to find out more about engineering, what would you suggest they do?

19) Are there any particular resources you would suggest to your students for learning more about engineering—Web sites, books, etc?

Yes No

If yes, what are they?

Engineering Student Survey

Thank you for participating in our survey. We welcome your honest and thorough feedback.

- 1)** First, please complete the following information:

Your School: _____

Your Major: _____

City/Town: _____

State: _____

Country: _____

- 2)** What is your gender?

Male Female

- 3)** What year in college are you?

- 4)** Describe the moment/period when you made the decision to enroll in engineering.

What influenced your decision to enter the engineering field of study?

- 5)** How old were you when you first became interested in engineering?

- 6)** Do you have a parent/guardian who works or has worked in a science-related field?

- 7)** Growing up, did you know anyone employed as an engineer?

Yes No

If yes, did this person play a role in your decision to study engineering? How?

- 8)** How did you find out about engineering in high school? Who did you ask for advice/information?

- 9)** Did you participate in any engineering-related programs while you were in high school?
 Yes No

If yes, which ones? Please specify if the program was an in-school or outside of school program.

- 10)** Are you planning to become an engineer after you graduate?
 Yes No

Why or why not?

- 11)** If you were to give advice to a young person (high school student) interested in engineering, what would you tell them?
-

- 12)** What if I told you that national statistics show that girls are not as interested in engineering as boys, why do you think this is true?
-

- 13)** What do you think could make the field of engineering more attractive to female students?
-

- 14)** What do you think are the two most rewarding things about studying engineering?
-

- 15)** Lastly, what do you think is the most discouraging thing about studying engineering?
-
-
-

Engineer Survey

Thank you for participating in our survey. We welcome your honest and thorough feedback.

- 1)** First, please complete the following information:

Your field of engineering: _____

City/Town: _____

State: _____

Country: _____

- 2)** What is your gender?

Male Female

- 3)** How long have you been employed as an engineer?

- 4)** Describe the moment/period when you made the decision to become an engineer.

What influenced your decision to enter the engineering profession?

- 5)** Do you have a parent/guardian who works or has worked in a science-related field?

- 6)** Growing up, did you know anyone employed as an engineer?

Yes No

If yes, did this person play a role in your decision to become an engineer? How?

- 7)** What are the two most rewarding things about being an engineer?

- 8)** What is the most discouraging thing about being an engineer?

- 9)** If you were to give advice to a young person (high school student) interested in engineering, what would you tell them?

10) Have you ever participated in outreach programs aimed at getting kids involved in engineering?

- Yes No

If yes, which ones?

11) How often do you participate in engineering outreach events?

12) Please rate your agreement with the following statements on a 5-point scale,

1	2	3	4	5
Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree

I am comfortable working with kids.

- 1 2 3 4 5

I am comfortable leading a workshop for teachers and career counselors about engineering careers.

- 1 2 3 4 5

I would volunteer my time to work in programs that get more kids interested in engineering careers.

- 1 2 3 4 5

13) What if I told you that national statistics show that girls are not as interested in engineering as boys, why do you think this is true?

14) What do you think could make the field of engineering more attractive to female students?

Messaging Survey—Phase 2

Thank you for participating in our survey. There are 17 questions in this survey. It should take no longer than 15–20 minutes to complete. We would appreciate your honest and thorough feedback.

Part 1

- 1) In order to verify your invitation to participate in this research, please complete the following information. Submitted information will not be used for any other purposes.

First Name: _____

E-mail Address: _____

City/Town: _____

State: _____

- 2) What is your age?

- 3) What grade are you in?

- 4) What type of school do you currently attend?

- 5) Please rate on a 5-point scale, where 5 = Very important and 1 = Not at all important, how important the following are for you when thinking about your future profession.

1	2	3	4	5
Not at all important	Somewhat not important	Neutral	Important	Very important

Making a difference—helping people, making your mark

1 2 3 4 5

Flexibility—ability to travel and/or work non-traditional hours

1 2 3 4 5

Income—making a lot of money/good salary

1 2 3 4 5

Enjoying what you do—making a hobby/passion a job

- 1 2 3 4 5

Positive working environment—good co-workers, atmosphere, location

- 1 2 3 4 5

Part 2

Now, I'd like for you to read the following set of examples and answer the questions for each.

Example 1

Starting salaries with select majors (with 4-year college education)

Journalism	\$24,000–\$32,000
PR	\$25,000–\$38,000
Teacher	\$27,000–\$34,000
Marketing.....	\$30,000–\$38,000
Nursing.....	\$34,000–\$42,000
Engineer	\$45,000–\$56,000

Engineering earns the highest starting salary.

- 6) Thinking about Example 1, please rate the following phrases on a 5-point scale, where a 5 means Strongly Agree and a 1 means that you Strongly Disagree:

1	2	3	4	5
Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree

I found this surprising.

- 1 2 3 4 5

This meets my expectations about engineers.

- 1 2 3 4 5

This makes me more interested in the engineering profession.

- 1 2 3 4 5

Example 2

Born and raised in Lexington, MA, Amy Smith wants to solve problems that plague huge segments of the world's population. She helps people at the far end of dirt roads in the world's most remote societies, often without electricity and no clean water. She has helped build grain-grinding mills and water-purification systems, a sunflower seed oil press, an animal-driven pump, and a low-cost rickshaw. Amy is a mechanical engineer. She encourages students to develop designs to solve community problems.

- 7) Thinking about Example 2, please rate the following phrases on a 5 point scale, where a 5 means Strongly Agree and a 1 means that you Strongly Disagree:

1	2	3	4	5
Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree

I found this surprising.

1 2 3 4 5

This meets my expectations about engineers.

1 2 3 4 5

This makes me more interested in the engineering profession.

1 2 3 4 5

Example 3

As a 13-year-old girl from Venezuela, Oksana Wall visited Disney World in Florida and the Magic Kingdom immediately cast a spell on her. "I knew I wanted to work for Disney," Wall says. "It was such a happy place." Fastforward 17 years, and the now 30-year-old Wall has worked for three years as a project engineer for Disney's Ride & Show Engineering Group. She's worked on such attractions as Rock 'n' Roller Coaster, Splash Mountain, and the Mini-Adventures of Winnie-the-Pooh. Wall received her B.S. and M.S. degrees in civil engineering from the Florida Institute of Technology. And she's been cited by the National Society of Professional Engineers as one of the "50 Engineers You Should Meet." She encourages young people to consider an engineering career, especially women and minorities. Engineering, Wall says, allows her to use her knowledge, experience, and creativity. "I have a blast at my job."

- 8) Thinking about Example 3, please rate the following phrases on a 5 point scale, where a 5 means Strongly Agree and a 1 means that you Strongly Disagree:

1	2	3	4	5
Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree

I found this surprising.

1 2 3 4 5

This meets my expectations about engineers.

1 2 3 4 5

This makes me more interested in the engineering profession.

1 2 3 4 5

Example 4

Read the following quotes from three professional engineers on what they think about their jobs. After each quote, please answer the question.

4A. *“Being a woman in a man’s world. It’s terrific!”*

- 9) Thinking about Example 4A, please rate the following phrases on a 5-point scale, where a 5 means Strongly Agree and a 1 means that you Strongly Disagree:

1	2	3	4	5
Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree

I found this surprising.

1 2 3 4 5

This meets my expectations about engineers.

1 2 3 4 5

This makes me more interested in the engineering profession.

1 2 3 4 5

4B. *“I love working in teams to develop new, innovative concepts and bringing those concepts into reality.”*

10) Thinking about Example 4B, please rate the following phrases on a 5 point scale, where a 5 means Strongly Agree and a 1 means that you Strongly Disagree:

1	2	3	4	5
Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree

I found this surprising.

1 2 3 4 5

This meets my expectations about engineers.

1 2 3 4 5

This makes me more interested in the engineering profession.

1 2 3 4 5

4C. *“Not only do I get to be creative and design new things, but I get to do it in a way that makes people’s lives better.”*

11) Thinking about Example 4C, please rate the following phrases on a 5-point scale, where a 5 means Strongly Agree and a 1 means that you Strongly Disagree:

1	2	3	4	5
Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree

I found this surprising.

1 2 3 4 5

This meets my expectations about engineers.

1 2 3 4 5

This makes me more interested in the engineering profession.

1 2 3 4 5

Part 3

You already know from our bulletin board focus groups that statistics show girls are less likely than boys to become engineers. You've also read a few stories and examples about what it's like to be an engineer. Now, please imagine that you are in charge of an advertising campaign to get people like you more interested in the field of engineering.

12) As the head of advertising, if you had to pick one of the examples you read to use for your campaign, which one do you find most compelling?

- Example 1: Salary comparison of engineering majors
- Example 2: Story—Amy Smith and solving world problems
- Example 3: Story—Oksana Wall and Disney World
- Example 4A: Quote—*“Being a woman in a man’s world. It’s terrific!”*
- Example 4B: Quote—*“I love working in teams to develop new, innovative concepts and bringing those concepts into reality.”*
- Example 4C: Quote—*“Not only do I get to be creative and design new things, but I get to do it in a way that makes people’s lives better.”*
- None of the Above

13) Please explain why you chose to use this example.

14) As the head of advertising, trying to tell a positive story about why people like you should become engineers, what else would you say or do?

Part 4

Lastly, I want your opinion on an engineering Web site. Please take a moment now and open a separate window in your Internet browser so that this window stays open. You can do this by going to your file menu and selecting “New Window.” Now, please copy and paste this URL in the new window: www.engineergirl.org

15) Please explore the Web site and give your rating on a 5-point scale, where 5 means you love it and 1 means you hate it.

1	2	3	4	5
I hate it		Neutral		I love it
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

16) Thinking about your experience with the Web site, please rate the following phrases on a 5 point scale, where a 5 means Strongly Agree and a 1 means that you Strongly Disagree:

1	2	3	4	5
Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree

I would visit this Web site again.

1 2 3 4 5

This makes me more interested in the engineering profession.

1 2 3 4 5

17) Any additional comments on the Web site?

Credits

This report reflects the generous contributions of the individuals and organizations that are part of the Extraordinary Women Engineers Coalition.

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