2006-1145: WHERE THE GIRLS ARE: APPLYING AN INTEGRATED MARKETING APPROACH TO ATTRACT GIRLS INTO ENGINEERING PROGRAMS

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Where the Girls Are: Applying an Integrated Marketing Approach to Attract Girls into Engineering Programs

Abstract

The steady national decline in women engineering students persists despite a plethora of programs and camps at engineering colleges around the country aimed at attracting girls into engineering and technical fields.[1] Discussions about this decline often suggest that influential cultural, media and marketing images may affect girls' career choices in ways that steer girls in directions other than engineering. When planning the first-ever overnight engineering camp for high school girls hosted at Boise State University, the planning team decided to embrace marketing methods to create realistic images about engineering that are relevant to the lives of girls. The planning team represented a partnership among Micron Technology, the southwest Idaho Society of Women Engineers section, Boise public school staff, and Boise State University faculty, staff and graduate students. The team defined four messages that formed the foundation for curriculum development and communications with prospective participants: 1) Engineers help the world; 2) Engineers think creatively; 3) Engineers enjoy working with other people; and 4) Engineers earn a good living. Demand for the "e-Girls" camp far exceeded expectations, and student evaluations at the end of the program indicated success at affecting the girls' understanding, perceptions and interest about engineering careers. The program will continue in 2006.

Background on Engineering Outreach Programs for Girls and Women

In 1993, the National Science Foundation launched the Program for Women and Girls to broaden girls' and women's participation in science, technology, engineering and math.[2] Over the next decade more than 250 projects were funded nationwide by this NSF program, including innovative endeavors such as Shampoos Etc!, a science and chemistry exploration adventure at State University of New York, Binghampton, and Bring Your Mother to Engineering School at California State University, Los Angeles. NSF reported that these and other creative programs engaged girls and women through hands-on activities, teamwork, role modeling, and other methods.[3]

These excellent NSF supported programs and other engineering and science programs geared toward girls and women have not, however, been able to prevent the decline in the number of young women choosing to pursue engineering professions. The United States has seen a steady drop in the percentage of women engineering students. As a percentage of the freshman engineering class, female enrollment declined from 19.9 percent in 1996 to 16.3 percent in 2004. Figure 1 shows the changes in freshman and total female enrollment percentages in U.S. engineering colleges.[4,5] Business leaders in the United States have warned that a shortage of skilled technology workers will threaten the nation's ability to compete in the global marketplace, and that the lack of women and minorities in technology fields amplifies the shortage.[6]

So why are girls, especially those who are academically prepared and capable, not enrolling in engineering programs? That question was the starting point in 2004 for a new national initiative,

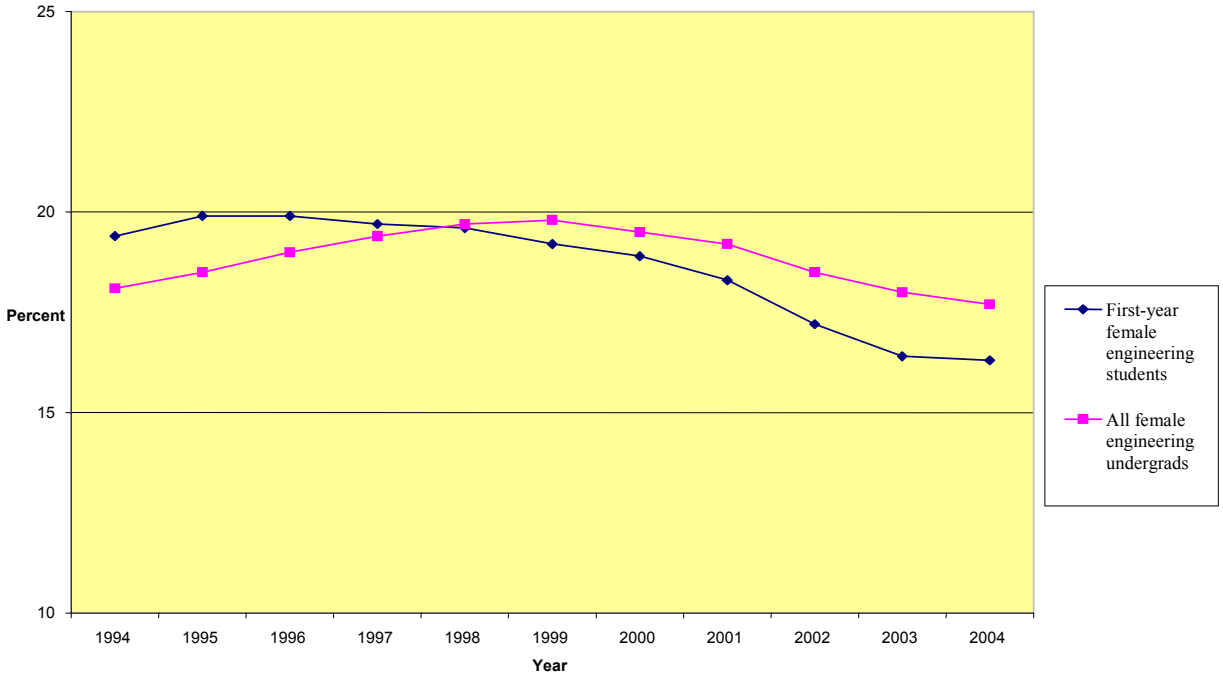

Figure 1: U.S. Undergraduate Women Engineering Enrollment
(Source: WEPAN and Engineering Workforce Commission[4,5])

the Extraordinary Women Engineers Project (EWEP), a coalition of engineering associations and the WBGH Educational Foundation, with support from the National Science Foundation and more than a hundred corporations, individuals and organizations. Based on 18 months of research, focus groups and surveys to address that perplexing question, the EWEP produced its final report in 2005. The report, "Extraordinary Women Engineers," with First Lady Laura Bush as the honorary chair of the advisory committee, called for **"a fundamental shift in the way engineering is portrayed"** in order to increase the number of academically prepared girls who pursue engineering education and careers.[7] The coalition recommended that educational and community programs should focus on young women's career motivators and should portray the rewards and benefits of an engineering career.

The Boise "e-Girls" camp that is the subject of this paper represents a subtle but fundamental shift in the way engineering is portrayed. Although the e-Girls program includes relevant and exciting hands-on engineering projects, the program is not solely focused on providing activities to persuade girls that engineering would be a good career choice. Instead, e-Girls activities have deliberately been created based on the passions and motivations of many young women, such as making the world a better place or earning a good salary. The learning space created by e-Girls enables the girls to discover for themselves how engineering fits with their personal goals. This subtle shift allows the interests of the girls, rather than topics of engineering, to become the central focus.

The Creation of a Boise Engineering Camp for Girls

The idea for a high school girls-only science, engineering, and technology camp in Boise, Idaho was initiated by a science and technology teacher from a local high school who was concerned

about the lack of girls in technology classes. Additionally, in Idaho the number of women in engineering and technology fields falls below the national average, with women students comprising about 12 percent of the population at the state's three public engineering colleges. The lack of women in technology and engineering careers in Idaho is further exacerbated by the low percentage of women attending college. In 2000, 19.4 percent of women in the state had earned college degrees compared with 22.8 percent nationally. Even so, the proportion of Idaho women age 25 and older with high school diplomas was 85.2 percent compared with 80.7 percent nationally.[8] Generally, Idaho's young women are completing high school but not college. The gap between high school and college attainment indicated a need to focus new programs on encouraging high school girls to go on to attain college degrees.

The teacher applied for a grant from the Micron Technology Foundation and then partnered with the local section of the Society of Women Engineers (SWE), other high school staff, Micron Technology, which is headquartered in Boise, and Boise State University, the regional metropolitan university. The missions of all of these entities already included an array of educational programs for high school students. A community planning team was formed with representatives from those constituencies. In 2004, the team obtained materials used by other young women's technology programs around the country and planned a camp called Females on the Fast Track: A Two-Day Camp for Girls Exploring Technical Careers and Opportunities. Due to the late start at planning and announcing the camp, only three girls signed up for the program, so the camp was canceled. (The three girls were invited to come to the Boise State University campus, where they enjoyed doing projects with a woman engineering professor.) In 2005, the planning team started over, and this time they employed marketing strategies to determine themes that would interest young women in the region, and to promote the camp.

Using Marketing Concepts to Develop Themes for the Girls' Camp

Like engineering, marketing is an evolving discipline that incorporates data analysis and strategic planning. The planning team embraced key marketing principles – collecting data to characterize the target audience for a girls' camp, creating a product to meet the needs of the target audience, and establishing and communicating consistent and strategic messages. The general public often thinks of marketing as a process where a business or institution convinces a customer to believe its message or buy its product. However, customer focused marketing seeks to provide the customer with what she/he needs, believes or wants, within the scope of how the sponsoring institution's mission and services can meet the customers' needs.[9] In the case of the girls' camp, the emphasis was not so much on the product (the camp activities) as on providing a program that would benefit the camp participants by meeting their interests.

The planning team utilized an integrated marketing communication (IMC) strategy to give planning team members and program volunteers a common vision to guide program planning, development, implementation and promotion. Robert Sevier, a nationally known higher education marketing consultant and author, defines integrated marketing communication as:

> A comprehensive, coordinated, institution-wide effort to communicate mission-critical values and messages in ways that target audiences notice, understand and respond to. IMC [integrated marketing communication] stresses data-driven segmentation, message integration and evaluation.[10]

The team established the program's "mission-critical values and messages" by the process defined in the next section. From then on, all fundraising, curriculum, promotional materials, messages, presentations and activities, and all staff – from dean-level to volunteers – supported the central themes.

Where are the Girls?

The mission-critical values and messages were derived based on the planning team's discussions, observations, and research about the interests and motivations of high school girls. The team wanted to determine "where the girls are" and devise a camp to meet them there – academically and personally. The following trends help locate the interests and goals of teenage girls:

1. **They are in Advanced Placement (AP) classes in record numbers.** Of the 30 AP exam areas reported by the College Board in 2005, female participation exceeded male participation in 17 subjects and tied in two subjects. Males, however, hold a slim majority in first-level calculus, and a wider margin in computer science, physics and others. Table 1 shows a sampling of subjects.[11]

Table 1: Participation by Gender in Selected AP Exams – 2005 (Source: College Board)[11]

Subject	(%) Female	(%) Male		Subject	(%) Female	(%) Male
Art History	68	32		Physics AB	35	65
Biology	59	41		Physics C (Mechanics)	27	73
Calculus AB	48	52		Psychology	65	35
Calculus BC	41	59		Spanish Lang.	65	35
Chemistry	46	54		Statistics	50	50
Computer Science	15	85		Studio Art	68	32
English Lang. & Comp.	63	37		U.S. History	55	45
Environmental Science	56	44		U.S. Gov. & Politics	53	47
French Language	70	30		European History	53	47
Human Geography	54	46		World History	55	45

2. **They are on sports teams.** Nationally, 51 percent of high school girls reported currently participating in team sports.[12] The Boise community reflects a similar focus on sports.

3. **They have little contact with women in engineering fields.** With only about 11% women[13] in the overall engineering workforce, teenage girls are unlikely to encounter women engineering role models. Even if young women choose to major in engineering, many students nationally will earn their bachelor's degrees without ever being taught by a female professor.[14] (Although, Boise State University has an unusually high percentage of female faculty, at three times the national average.)

4. **They are flocking to professions where they feel they can make meaningful contributions to society, medicine, justice and prosperity.** Women dominate in health profession undergraduate degrees (85%),[15] biological and biomedical sciences (62%), psychology (77%), and business (51%), and have achieved equity in medical school and near equity in law school. Similarly, women are more likely to earn engineering degrees

in fields directly associated with perceived societal contribution, such as biomedical and environmental engineering, as shown in Table 2.[16]

Table 2: Bachelor's Degrees 2004, Selected Engineering Disciplines (Source: ASEE)[16]

Degree	% Earned by Women		% Earned by Women
Biomedical engineering	45.5%	Metallurgical & Materials	31.2%
Environmental engineering	40.6%	Engineering management	28.8%
Agricultural engineering	37.1%	Civil engineering	23.1%
Chemical engineering	36.5%	Electrical engineering	15.0%
Industrial/Manufacturing	34.6%	Mechanical engineering	13.7%

5. **They tend to be more independent than their parents.** Focus groups and surveys by the Extraordinary Women Engineers Project indicate today's young women are self sufficient and want rewarding career options.[17]

6. **They don't want to work in a cubicle, isolated from other people.** Anecdotally, this is probably the fear most frequently expressed by high school girls visiting the university. Girls and women generally value working in friendly settings with personable co-workers.[18]

7. **They live in a culture where the public often perceives engineers as nerdy, un-athletic, solitary, or uncreative.**[19] These persistent stereotypes are perplexing to those in engineering professions who recognize that engineering discoveries, creations and designs profoundly and positively affect the daily lives of people everywhere.

8. **They may excel in a single-gender environment in technical subjects.** The high school teacher who first proposed this camp had only two or three girls each year in his A+ Certification (computer technology) class, until he hosted a girls-only section that drew 25 girls. National studies show higher performance by girls in some single-gender technical classes.[20]

Taking into consideration the general interests of teenage girls, four message themes were developed as shown in Figure 2. The four message themes were: 1) Engineers help the world. 2) Engineers think creatively. 3) Engineers enjoy working with others. 4) Engineers earn a good living. The program was titled "e-Girls," a two-day adventure for girls exploring engineering and technical careers and opportunities. The "e" stood for energetic, enthusiastic, exciting, and engineering.

Over the next several months, the team developed 8-10 learning modules, purposefully including projects to meet identified interests of girls, such as environmental (Packaging and the Environment), sports (Physics of Rock Climbing) and medical (Biomechanics of High Heeled Shoes). All modules emphasized teamwork, creative problem solving, and hands-on learning. Although the modules were fun, they were not "dumbed down." The team was not afraid to

tackle advanced subjects such as automatic control systems and rocket propulsion. Every module emphasized multiple career options and college majors.

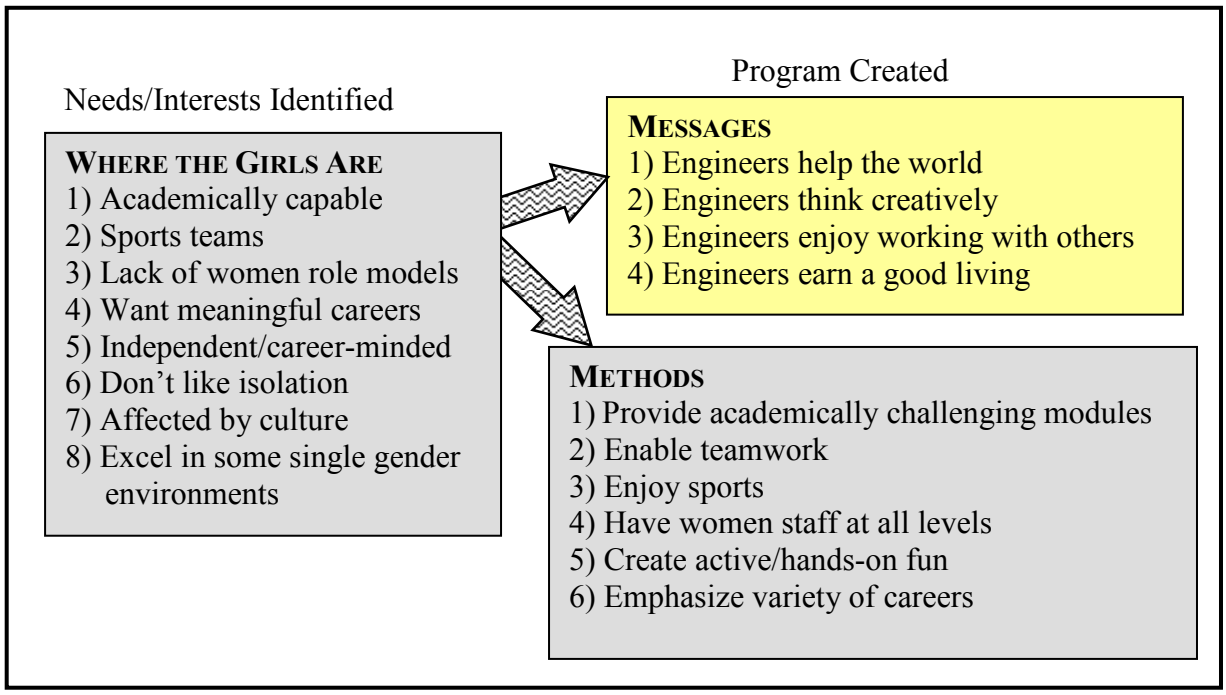

Figure 2: Creating e-Girls Messages and Methods

Because many girls in southwest Idaho are involved in weeklong sports camps, the team chose a two-day, Friday-Saturday format for e-Girls to make it convenient for as many girls as possible. An overnight component was added for camaraderie and to provide a taste of dorm life. With funding from Micron and other sponsors, the program was offered free of charge. Flyers were printed emphasizing the four message themes. Micron, SWE members, and school counselors and teachers around the state were instrumental in distributing the flyers to students. Girls filled out a simple application and wrote one paragraph about why they wanted to attend. Other than entering 10th or 11th grade, no academic or GPA requirements were set. Girls were accepted on a first-come basis, and registration for e-Girls filled up quickly.

Implementation

The first annual e-Girls was held on June 10-11, 2005. The e-Girls schedule is shown in Table 3. Forty-one girls from all around the state participated in this event on the Boise State University campus. Girls represented a wide variety of ethnicities, personal interests and academic abilities. Although demographic information was not collected in 2005, plans are under way to collect demographic information for the e-Girls camp in 2006. Workshops were led by members of the local SWE section, current engineering students, school district staff, and corporate representatives. In all, about 25 staff and volunteers (about 75% women) helped in some way. The facilitators generally enjoyed the camp as much as the girls and found the teens to be inquisitive, creative, cooperative, enthusiastic and open-minded.

Table 3: e-Girls Schedule

Friday, June 10, 2005		Saturday, June 11, 2005	
Time	***Activity***	***Time***	***Activity***
Morning			
8:30 – 9:30	**Intro to Engineering & Technology**	8:15	Check out of Dorm
9:30 – 10:45	Activity 1 and 2 (split into 2 groups of 22)	8:30 – 9:00	Breakfast
	Activity 1: **Biomechanics of High Heels** Activity 2: **Fun with Chemistry**	9:00 – 9:30	**The Future of Engineering and Technology**
10:45 – 11:00	Break	9:30 – 10:45	Activity 5 and 6 (split into 2 groups)
11:00 – 12:15	Activity 1 and 2 (groups switch)		Activity 5: **Rocket into Space** Activity 6: **Planning a Future City**
Afternoon			
12:15 – 1:00	Lunch	10:45 – 11:00	Break
1:00 – 2:15	Activity 3 and 4 (split into 2 groups)	11:00 – 12:15	Activity 5 and 6 (groups switch)
	Activity 3: **Networking** Activity 4: **Packaging and the Environment**	12:15 – 1:00	Lunch
2:15 – 2:30	Break	1:00 – 2:15	Activity 7 and 8 (split into 2 groups)
2:30 – 3:45	Activity 3 and 4 (groups switch)	2:15 – 2:30	Activity 7: **Secure Communication** Activity 8: **Balance & Control of a Segway Ride**
3:45 – 4:30	**Career Awareness**	2:30 – 3:45	Break
4:30 – 5:30	Check in to Residence Hall	3:45 – 4:15	Activity 7 and 8 (groups switch)
Evening			
5:30 – 6:30	Dinner at Tablerock Café		Wrap up
6:30 – 9:00	**The Physics of Rock Climbing & Slack Lining**		
9:00	Chic Flicks		

Results and Evaluations

At the end of the camp a few girls had to leave early for rides home, but 37 of the 41 girls stayed and filled out anonymous evaluations that asked questions about the general program and specific modules. A subset of the information collected is given in Table 4. The girls' overwhelmingly positive answers to the questions "Would you recommend it [e-Girls] to prospective participants?" and "How has e-Girls affected your interest in engineering or a technical career?" indicated that the camp was successful at merging these high school girls' interests with positive perceptions about engineering. Note that 100 percent of the participants would recommend the camp, and 100 percent felt they were more interested in engineering than they were at the beginning of the camp, with 66 percent being "a lot more interested." Perhaps even more telling about the effect of the program were the abundant and astute comments that the girls wrote on the evaluation forms, a subset of which are also given in Table 4.

Table 4: e-Girls Evaluations

Would you recommend it to prospective participants?	Yes	No
	37	0
How has e-Girls affected your interest in engineering or a technical career?		
Less interested	A little more interested	A lot more interested
0	6	31
How would you rate each activity on a scale from 1 to 5, with 1 being the lowest and 5 being the highest?		
Compiled results for each activity	Mean	Standard Deviation
The Physics of Rock Climbing	4.65	0.63
Rocket Into Space	4.62	0.55
Fun with Chemistry	4.54	0.69
Balance and Control of a Segway Ride	4.53	0.74
Packaging and Environment	4.11	0.74
Networking	4.00	0.94
Biomechanics of High Heels	3.68	0.85
Career Awareness	3.59	1.17
Planning a Future City	3.42	1.18
Secure Communications	3.34	0.68
What did you learn about engineering and technical careers that you didn't know before? (representative samples taken from 36 responses)		
Engineering makes a good base for a lot of different subjects, so if I change my mind after the first few years of college, it's OK.		
It applies to everything and with a degree in it virtually all doors are open to you.		
Engineering is more a way of thinking than just a specific career.		
Things you think have nothing to do with technology (like high heels) do. You can be an engineer and not just fix cars, but work in a field that fits your interests.		
The things I learned are so many that I cannot list. This is great for young girls like us who don't know what opportunities we have.		

The girls were asked several questions about what they disliked about the camp, and almost all of the responses concerned peripheral details – the dorm, the food, the shortness of the program, some interpersonal relationships among girls. Four girls didn't like specific modules. One girl deemed some facilitators' comments about high paying engineering salaries to be critical of non engineering professions. Even so, all negative comments will be considered when planning the next year's program.

Follow-up and Future Plans

The e-Girls participants were contacted one month after the program and sent a CD of photos. The girls have also been invited to events such as Discover Engineering Day sponsored by Micron, Boise State University and other partners, and to an industry networking dinner sponsored by the student SWE chapter.

e-Girls will continue in 2006 with the following changes.

- Demographic data will be collected on the participants. The southwestern Idaho region has a rapidly growing Hispanic population that has more than doubled in just over a decade. Although the first e-Girls included several Hispanic students, collecting demographic and family educational information may be helpful as the program recruits more Hispanic girls and more sponsors to expand the program.
- The team will include a question about interest in engineering on the initial application to establish a baseline for pre-program interest level.
- Since several girls asked about forensics – a field whose popularity has been spurred by television drama shows – a forensic engineering unit is being added this year. Also new in 2006 are a welding unit, because almost all the girls liked hands-on creating, and possibly a wind energy unit, because of the interest of many young people in renewable energy.
- Plans are under way to systematically track the participants and their educational choices and to invite them to College of Engineering preview days at Boise State University as they proceed through the college application process.
- e-Girls participants will be offered academic advising to help them plan their high school class selections. Several of the participants expressed a belief that they would not be eligible to apply to engineering school because they were not on the advanced math or science track in their high schools. In fact, at Boise State University, nearly 60 percent of the successful mechanical engineering graduates, for example, entered college at a math level below calculus.
- Distributing information about e-Girls will give the program creators opportunities to educate school counselors and teachers about the facets of engineering that girls seem to find appealing and about engineering education in general.

Summary

The planning team set out to discern "where the girls are" in their interests and to design a program to meet them there, with the goal of creating perceptions about engineering that are relevant to a regional group of high school girls. The team utilized strategic planning and integrated marketing communication to craft a program that would meet the girls' academic,

personal, and career interests and passions. The preliminary results (the participant evaluations) strongly suggest that it is possible to affect high school girls' interests and potential career choices by giving them a learning space where they can discover how engineering fits their talents and goals. The program was so well received that in fall 2005 Boise State University was already receiving calls from students and parents about summer 2006 e-Girls.

Perhaps the most astonishing result of e-Girls was its 100 percent approval rating – every teenage girl who participated and filled out a survey (37 of 41) agreed that she would recommend the camp to others. Based on this intriguing result the authors believe that even though e-Girls is a new program, it demonstrates a viable way to create a fundamental shift in the way engineering is portrayed, as called for by the Extraordinary Women Engineers national initiative. The e-Girls team did not take on the Herculean task of changing national perceptions about engineering. Rather, they set out to meet the needs of one regional group of 41 high school girls, and in doing so showed that it is possible to affect the perceptions and interests of teenage girls regarding engineering. Many current engineers and faculty chose the field because of their interests in math or science. The motivators for many young women today, while different from the interests of previous generations, are no less legitimate. The engineering community must recognize that the interests of capable young women to create, work collaboratively, or help make the world a better place are valid and outstanding reasons to pursue engineering careers. Marketing techniques are valid tools to build a bridge between young women and relevant messages about the benefits and joys of engineering.

Acknowledgements

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