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Women in Engineering: Shifting the Balance

Writing Process

This writing was submitted as the final research paper for my English class. The paper includes analysis of multiple sources and my original research done via survey of female engineering students at the University of Dayton. The paper underwent several peer reviews in class, assessed by the professor before submission, and was critiqued at the Write Place before submission.

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Women in Engineering: Shifting the Balance

According to the U.S. Census Bureau, women only accounted for 13% of the engineering-related workforce in the past twenty years (Cole 1). There has been a push to bring more females into the engineering field, but progress has been slow or nonexistent. In the statistics published by the National Science Board, from 1977 to 2002, the percentage of female college freshmen intending to major in engineering went from 9.9 to 11.5, a change of only 1.6% (National Research Council). Due to these extremely poor numbers, an increased push to support the entrance of women into engineering must be accomplished. Several major obstacles must be overcome to increase the number of female engineers. These include reducing and defending against the stereotypes found throughout society, encouraging female engineers to provide support for girls at a young age and creating programs for these young women to understand what engineering is and what engineers really do.

As noted in *Electronic News*, a typical engineer is “a man who is brilliant at and passionate about technology, but not so good at dealing with people” (“Stereotypes”). When people picture an engineer, it is common to see a man in a business suit looking at a project design or doing complex math equations. The thought of a female rarely comes to mind because this type of occupation is typically considered a man’s job. Susan Staffin Metz provided an example of this: a speech the president of Stanford University, John Hennessy, gave on engineering and diversity. He said, “We have [TV] shows about doctors, lawyers, and

politicians. Where are our role models of scientific innovation? We need Eddie the Engineer or Sam the Scientist.” A concern expressed about Hennessy’s statement was the way he described an engineer. People were outraged by the comment, asking questions such as “Could Sam have been Samantha?” (202). Stereotypes of engineers as men are damaging to women who are debating whether or not to enter engineering. The current image of an engineer does not help to counter the belief that the engineering field is off limits to them.

Often, people do not realize that their comments are based on stereotypes because it has become natural in society to think this way. Susan Sturm, an accomplished professor of law and social responsibility at Columbia Law School, points out these subtle biases. She states, “[these] differences in treatment often occur without anyone noticing. They reflect unconscious biases reinforced by cultural patterns and shared by men and women alike” (262). She goes on to explain that many of the same ideas are reflected in mass media. Depictions of engineers which do not match gender or personal characteristics of women add to the stereotype that engineering is not for them. Even women engineers are susceptible to these stereotypes.

In November 2015, I conducted a survey of 35 female engineering majors at the University of Dayton (survey attached). These women were selected at random from the main lobby of Kettering Laboratories and consisted of a wide range of races, ages and engineering majors. When asked why they decided to study engineering rather than a different major, eleven of the women responded by saying they like math. Some of these engineers even stated that an engineer is someone who enjoys doing math. They are all correct that having an interest in math can be beneficial when studying engineering, but there is more to it. This leaves the sixty-eight percent of women surveyed who were not necessarily big fans of math, yet they still chose to become engineers. Furthermore, only three of the women surveyed correlated engineering with

being 'smart'. More than half of the responses described an engineer as a problem solver and someone who makes life better for others and improves society. These young women decided to study engineering in spite of the harmful effects of media.

One way that youth use media to learn about engineering is through the internet. In Metz's essay, she researched several popular websites discussing engineering including CollegeBoard.com and WorldWideLearn.com. Common themes present in these depictions of schooling related to engineering included 'math' and 'difficult' (195). The websites attempt to turn away people who struggle in math and science or others who do not frequently reverse engineer devices, play video games consistently, or participate in other stereotypical activities characteristic of engineers (194-200). When people turn to these types of websites to learn more about engineering and deciding if it is the field for them, they are receiving the wrong message. Due to this, the portrayal of engineering needs to be drastically changed.

To combat these stereotypes, media outlets need to show who engineers are and what they really do: They are active men and women in society who are there to help provide humanitarian support for people across the world and solve problems we face in our daily lives, not just build fast cars and rockets. The female engineers at the University of Dayton were able to learn the truth about engineering, so the rest of the world can too. Metz reviewed a study conducted by WGBH Educational Foundation, which found that high school girls say they want to learn that engineering is more than just what they hear about. They appreciate hearing that engineers are not stuck in the office all day working on the computer to draft new designs. Some of the opportunities which are important to them include traveling around the world for work, making a steady income, helping others in need, and doing fun hands-on projects (Metz 191).

Since this is what many engineers get to do, there is no reason for depicting engineers as men who do boring math calculations in the office all day.

Before anything can be done to help increase the number of women in engineering, we need to first prevent these stereotypes from being created which depict engineers as being all men who work on projects which only men would be interested in. Once the media accepts the idea that an engineer can be a woman and changes its depictions of what an engineer is and does, the general public will begin to understand engineering and move away from these stereotypes. As stated by one of the women in my survey, “[an] engineer can be anything or anyone that finds a certain problem [and] works to fix it.”

Referring back to the comment about role models made by the Stanford University president, John Hennessy, he is correct in saying that high school level women need to have more female mentors in the engineering field. In a research paper by the Army Research Laboratory, Melanie W. Cole noted that “it is important to offer STEM mentoring programs to women at the high school level” because these young women are “strongly influenced and/or mentored by female role models” (Cole 4). It is easy to find people of other occupations in the media who are successful, but engineers are seldom seen. When young women see a successful female engineer from their potential occupation or an experienced female in college, these girls are able to gain confidence in knowing that someone has been in the same situation before and was able to thrive. These mentors can spend time with their mentees to discuss challenges the mentor faced and how to overcome obstacles. Mentees can also learn of potential opportunities available which can help them become successful in engineering as well. Having a positive influence available to encourage these young women will help promote self-esteem and, therefore, additional confident female engineers.

To make mentors readily available to young women, professional and college organizations need to create a strong connection with lower level institutions, specifically K-12 schools. College students, especially graduate level students, need to enter the classroom often to show possible future engineers what the industry is by using experiments and presentations. High school girls who are serious about entering engineering will benefit from hearing personal experiences and stories about engineering from university students. Learning from people in the engineering field who are closer to their age will help them relate better and feel comfortable with talking and asking questions about becoming an engineer.

Another important source of support is friends and family. When the young women in my survey were asked what mentors helped make them decide to study engineering, all but four said they had a family member who supported them with ‘father’ being the most popular answer. Almost three out of four women surveyed said they had family members or close friends in their life who studied engineering. The mentors introduced some of these young women to engineering, answered questions, talked about their careers, helped with classes, and provided support when making important choices. Having a person like this whom they could trust became crucial to increasing confidence since they had an idea what they were going into and learned about engineering beforehand.

In addition to receiving help from mentors, women will be able to create a better vision of their future if they are exposed to the engineering field before choosing a major. Programs which bring young women onto college campuses and into the lab to meet faculty and students and engage in demonstrations will help stimulate their interest. A committee of the National Research Council studied a university that was working to increase female interest in the sciences at their institution by implementing several programs. One such program “begins by

bringing sixth-graders to campus in groups from the same city. By bringing the students back each year, the university hoped they will form a cohesive group and eventually enroll in the university's science and engineering program" (37). The program was considered a success and repeated each following year (37). A wide variety of programs such as this one should be available to area high school students who are interested in engineering. Short events can include high school field trips to colleges to meet faculty and see demonstrations in engineering labs. Programs can be more in depth for women seriously considering becoming engineers. For example, young women can stay on campuses for several days to learn many of the exciting aspects of engineering. Outside of these programs, women still need to have the opportunity to be exposed to engineering in other ways.

Within most high schools, there are few to no engineering classes available to students. Topics such as engineering design need to become available to adolescents who want to get their feet wet before jumping into the world of engineering. Furthermore, if possible, engineering classes should be single-sex classrooms with female teachers in order to avoid stereotypes associated with engineering. In this situation, women will be in an environment where they do not have to deal with male professors who tend to favor male students. They also will not be receiving unwelcoming signals from fellow students in a male-dominated classroom. These women will feel comfortable in a female-friendly environment working with other female students to orient themselves with the field of engineering.

Several programs have implemented these ideas and have been very successful. According to an article written by Susan Parrish for the *Columbian*, the Not Even Remotely Dorky (NERD) program worked with elementary and middle schools to increase student interest in science and engineering. The program initially was co-ed and only three of twenty-three

attendees were girls. “The second week, no girls showed up. [Recently], a girls-only NERD Girls program was offered at Harney [Elementary]. Here’s what happened when no boys were allowed: A dozen girls attended” (Parrish). In an additional article, Emily Johns described a STEM workshop for middle-school girls supported by Project Lead the Way. These young girls spent the day having fun, experimenting, and learning about science. Johns notes in the article that “[the] camp got rave reviews from the girls, who said they could really be interested in science in a supportive environment when they don’t have to worry about what their classmates think” (Johns). In both programs, the girls did not have the pressure of boys in the room who may judge them or create a negative environment. The NERD program provides a very clear example of how women will react to science and engineering opportunities when they know there will be no pressure from their male counterparts. These ideas can be projected into the classroom environment and help more young women become interested in learning about engineering.

Some people feel that putting young women into programs and classes such as these is detrimental to their opportunities as students. Mathieu Bouville makes the claim that these youth programs are coercive in attempting to make girls become engineers. He believes that, in the end, women lose the free choice of whether or not to be an engineering major (Townley 295-296). This is false because at any point these women can change to a different major. The university they attend cannot stop them from deciding to study something different. These programs are only trying to expose women to engineering and help them learn about the opportunities available because they are not accurately expressed in other formats. Knowing about more options of study will allow women to choose the major that best fits their characteristics.

Further disproving Bouville's conclusions, Daryl E. Chubin, a long time professor of sociology related to engineering, points out that Bouville ignores the facts behind the statements he attempts to argue. Chubin states, "In the empirical world, [. . .] there is a research base to which one can appeal. Bouville opts not to do so, [. . .] ignorant of the research" (9). As noted earlier in the essay, universities have attempted these programs in the past and were successful. This was not because they forced engineering on young women but because more students learned about what engineers really did in the workplace.

This protest taken care of, it is important to determine when many of these programs and classes should become incorporated into the lives of young girls. In an article written by Philip Sadler et al. for *Science Education*, the authors studied multiple surveys and different research to learn how interest in STEM subjects changed throughout high school for men and women. One result they discovered was that "the odds of reporting a STEM career interest [. . .] at the end of high school are about nine times as high for students who reported an interest in engineering or science careers at the start of high school" (Sadler et al.). This statistic means that girls need to be exposed to engineering in primary and middle school because chances are they will not change their mind while in high school. When younger, these girls are more open to learn and explore new ideas such as engineering. They are still unsure of what they want to do with their future career, and it is much easier to convince them to try programs and classes which promote engineering. Overall, the younger the women are, the more they will be willing to learn about engineering and discover how fun and thoroughly beneficial to society this important field of study is.

At this point it is safe to assume that women need help discovering the world of engineering and all the opportunities it has to offer. The effects of society's biases and

stereotypes can make it very difficult for women to build enough confidence to join men in engineering; therefore, these stereotypes need to be limited in conjunction with providing support to young women. Being very impressionable at a young age, they must be provided the proper image of engineering. This can be accomplished by providing female mentors to girls and giving them the necessary experience to truly discover engineering. With a combination of these efforts, the representation of women in engineering will increase, establishing a more diverse and creative environment for the engineering world.

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Please answer questions to the best of your ability. You can leave an answer blank if you prefer.

What is your age range? (check one box) <18 years ☐ 18-20 years ☐ 20-24 years ☐ >24 years ☐

What is your race? (check one box) Caucasian ☐ Hispanic ☐ Asian ☐ Other ☐ No answer ☐

What is your major?

How would you describe an engineer and what an engineer does?

What made you decide to study engineering rather than a different major?

What mentors did you have in your life to help you make this decision?

What previous experiences (i.e. programs, camps, classes) related to engineering did you have before studying at the college level?

Do you have other family members or close friends who studied engineering at some point? If so, what did they study and how did you interact with them about engineering?

What do you believe is the best way to inspire young women to become engineers?

Please list any other comments about how you have been influenced in your view of engineering.