

Women in Engineering

Despite all the recent advancements made by working class women for equality, there is still a real issue with the ratio of men to women in STEM careers. STEM, or science, technology, engineering and math, includes a wide variety of careers, and while some are doing better than others with their numbers, the engineering field is still suffering greatly. Studies conducted by the National Girls Collaborative Project have shown that female students earn only 19.2% of all engineering bachelor's degrees ("Statistics"). Of that small number, a lot of those women either won't continue in to a graduate program in engineering, will never go into the field, or will leave the career path all together. While there are multiple reasons for women leaving engineering, some of the most common reasons involve the work culture or a lack of advancement. It remains unclear if the best method for dealing with this is combating it while girls are in school, as they are entering the field, or after they're already in. Though it is important that help be provided to fix these issues, there's also the dilemma of helping too much and making women feel helpless. I personally believe that affirmative action is within the realm of possibilities to solve this issue, but may not be the best option. In order to find the best solution to this issue, the question must be asked, "Should companies use affirmative action to balance the male/female ratios in the engineering fields?" which

addresses the communities of girls who show interest in or start to pursue engineering and women in the engineering field.

One of the possible methods for improving the playing field for women is to start while they're still in school. Girls are often turned away from STEM classes at a young age which discourages them from enrolling in higher level classes later on. "The Institution of Engineering and Technology, a professional British society, found that only seven percent of mothers and fathers said they would encourage their daughters to pursue engineering careers". Parents are obviously incredibly influential to young children who would not wish to disobey their parent's wishes. This lack of encouragement puts girls in an inopportune position when it comes to getting ahead or even acclimated to the engineering world. In addition to this, in 2009 compared to males, lower percentages of female high school graduates reported that they liked mathematics or science and that mathematics or science was one of their favorite subjects (U.S. Department of Education) and at the college level, girls make up 42.4% of STEM students on average ("Getting Girls into Engineering" 4). Due to a lack of encouragement early on, girls continue to shy away from a chance to enjoy and excel at math and science because they are taught that those are subjects better suited to boys. There are also several girls who sign up for these classes but drop them because they feel unnoticed or left out by the teacher or their male classmates. If girls are encouraged to join and stay in STEM classes, the possibilities of them continuing into a related career are much higher because they will have the same experience and opportunities as their male colleagues. A male college engineering student speaking about his inequality with his female classmates said "In grade school I never feared being

rejected...because of my interests" (Pittman). He also reported a female calculus student say male students were hypercritical of her and talked over her in class (Pittman). Despite all of these disadvantages, some girls still pursue science and math degrees, as shown in a study by the U.S. Department of Education which found, "Compared to males, higher percentages of females earned credits in algebra II, pre-calculus, advanced biology, chemistry, and health science/technologies. However, higher percentages of males earned credits in physics, engineering, engineering/science technologies, and computer/information science" (Cunningham and Sparks 7). Basically what this means is girls may combat the lack of encouragement for entering math and science, but still shy away from engineering. To counter this, there are several programs geared towards getting girls interested in STEM such as IGED (Introduce a Girl to Engineering Day) or the ACE (Architecture Construction Engineering) Mentor Project. IGED is an annual event with a purpose to give young women a taste of what an engineer is and what they do. (Atom) and ACE is an after school program that introduces people to careers in architecture, construction management, engineering and other disciplines ("About Us"). Mara Braselton, a current associate of Thorton Tomasetti encouraged both programs by saying, "I think these programs are great mostly because they introduce girls to engineering. It shows them that there are many females in the industry and gives them a chance to ask questions and see what it means to be an engineer". These programs can be very beneficial to girls who need to make up for time lost in their younger years or to those who have never been introduced to engineering but show potential in math and science. Currently, young girls are at a massive disadvantage in the engineering, math and science areas, but ACE, IGED, and other

adjustments are being made in the classroom, these will be discussed in the next paragraph and are slowly improving their chances.

After the number of girls enrolling for STEM classes increases, the problem of keeping those girls in arises. Due to Title IX, passed in 1972, which prohibits discrimination on the basis of sex in any federally funded program or activity (Higher Education Amendments of 1972) teachers aren't intentionally picking on girls, but typically an environment is created where they do not feel equal to their male classmates. For example, "Studies within science classrooms have found that teachers tend to: call on boys more than girls, allow boys more talking time than girls, tell boys how to solve problems, but solve problems for girls (teach helplessness), and give boys more criticism and corrective feedback" ("Getting Girls into Engineering"). It is very possible that teachers don't even realize they are treating female students differently, but the repercussions may be girls not wanting to continue in these classes. In addition to this, there's often a stigma in advanced science and math classes that the girls just don't know what they're talking about, so their work is discredited by the boys and sometimes the teacher. In the words of the male student who discussed the inequality between him and his female classmates, "You and I are in fact unequal" (Pittman). To keep students from feeling unequal, does it fall on the teacher or the students to adjust the curriculum? In the guide released by the London Engineering Project titled "Getting Girls into Engineering" several methods are suggested for making girls feel more included such as, "use more gender-neutral colors such as orange/ bright green/ purple. Avoid referring to girls or a mixed group as 'guys'" and asking yourself as a teacher, "Is this activity traditionally appealing to both genders or traditionally appealing to boys (e.g.

cars, rockets, weapons)". As irrelevant as it sounds, many teachers do not make these small adjustments and just teach the class like they had in previous years. This may be because they do not recognize the problem or they aren't focused on actively keeping girls intrigued on the same level as boys. Some schools are finally taking the steps towards making engineering classes more "female friendly", though it may be unclear what that entails, the effort shows a positive outlook for future girls. For example, my own engineering teacher was approached about making his classroom more female friendly. The group that approached him with specific requirements which he described as "I was required to post more feminine friendly pictures, posters and other paraphernalia" which in this case meant "I allowed a student to print off several animated animals in an effort to soften the image of my room" (Breinin). It is safe to infer that other engineering teachers have been approached with similar requirements to make their teaching space more female friendly. This change in environment may be a very effective way to keep girls in the classroom long enough to finish and continue with courses.

Another option for equaling the ratio of men to women in engineering fields is to assist in women's search for jobs. Some companies still aren't interested bringing women into their ranks which is where affirmative action may be very beneficial. With this solution comes a lot of problems such as women getting hired over someone more qualified or women rejecting the idea of being a "protected class". "Affirmative action is an outcome of the 1960's Civil Rights Movement, intended to provide equal opportunities for members of minority groups and women in education and employment" ("Statistics"). Typically, this practice is associated with race, as most people don't

realize gender is even included with the practice since it was added six years later than the order's passing. In addition, a bill was passed in 1979 that worked to prevent discrimination against women in science and technology and increase opportunities for the employment and advancement of women in these fields (Congressional Research Service). Despite this bill being passed, it is not very well known, and has not achieved much by way of its original purpose. Even with this government assistance, women are still having a hard time finding jobs in the engineering field, and some never even enter the field after successfully completing college. The top 5 reasons women didn't enter the field after graduating with a degree as documented in a study conducted by University of Milwaukee personnel: not interested anymore, didn't like the culture, always planned to join another field, did not find career flexible enough, wanted to start own business (Fouad et al. 18). A phrase that is thrown around often as the main cause of women leaving is the 'work culture. The culture is very male dominated due to years of there being only men in the field as well as the old stereotype that women can't work science or technology jobs. This culture becomes present for women as they go through several interviews, new to the work field and in some cases feel "At some point, after many interviews, I decided I wouldn't want to spend the majority of my waking hours with the type of people interviewing me" (Fouad et al. 21). This is one of the strongest examples of the culture in engineering being male dominated, as women felt so uncomfortable in interviews alone that they decided to give up the field all together. Affirmative action may be a way to positively influence the engineering work culture so that more future women feel comfortable taking a chance and entering the field, possibly even staying.

Some people believe that affirmative action is outdated, and shouldn't be used anywhere, regardless of the circumstance. Additionally, hiring women through this method may cause them to be picked over more qualified males which could lead to a worse work force. A good example of this problem is present in universities where people believe "Merit requirements are grades, test scores and athletic, musical and leadership excellence. They are participation, understanding and willingness to learn and exceed expectations. Merit is not being born a certain race or sex" (CT Staff). Obviously this does not speak for the majority, but it does present a reasonable argument against affirmative action. Employers can prevent underqualified people from being hired simply because of their gender, by remembering "Affirmative action means taking positive steps to end discrimination, to prevent its recurrence, and to create new opportunities that were previously denied to qualified women and people of color" ("Affirmative Action"). Some advice offered to these employers by a woman researching the hiring of women is "If you're an employer for an engineering firm, hold managers accountable for their hiring and promotion decisions" (Moulton Belec). This is necessary because it allows employers to know that the most qualified person is getting hired or promoted. Hiring is only one of many problems women in the field are facing. Studies have shown women left the field because they lost interest, wanted to spend time with family and had an inflexible schedule, did not like the culture or tasks, or weren't offered opportunities for advancement (Fouad et al. 27). These issues are present for some women who often feel "I got to a certain point in my career when I no longer advanced" (Fouad et al.13) or "being a female minority, it was difficult to work with white men who were much older than me and did not share a similar background" (Fouad et al. 29).

Those women summarize the feelings of several others who left the field purely due to the work culture. Others are in much better work environments where "In those rare cases where I felt I was not being treated appropriately, I have been able to go to HR and management and talk through the situations and always felt I was being taken seriously and supported" (Fouad et al. 48), or are given flexible work conditions. While it is fantastic that some women have great working conditions, these are not present for several. It is a common understanding that there are not a lot of role models for female engineers in the field, but despite this, some women can say "I was fortunate enough to work with senior male engineering officers who gave me fantastic opportunities and provided outstanding support" (Fouad et al. 47). In some cases, a male engineer may stand up to mentor a woman new to the field, but some women do not find this as helpful as having a female mentor would be. Even if a woman can find herself in a good work culture where she feels comfortable, she still faces further obstacles. Once hired, women still face a significant wage gap, with women earning \$0.86 to every dollar a man makes (U.S. Department of Commerce). This is an issue that implementing affirmative action cannot fix.

The main problem with a topic like this is that there's not really one set way to help everyone affected. Helping girls at a young age may help the number of female engineers grow, but there's always the chance that boys could be pushed away due to the extra focus on the girls. Additionally, providing so much assistance to girls may make them less prepared to deal with how the engineering culture actually works. Forcing engineering companies to save some jobs for women may balance the ratios between men and women, but it may cause the men to resent the women for having an

easy way in. Additionally, once hired, a female engineer may face a male-dominate work culture, being passed up for promotions, an inflexible schedule that doesn't cater to those with a family, a lack of female mentors, and a wage gap. Implementation of programs like IGED and ACE as well as a slowly building shift in engineering classrooms to make things more equal will be helpful to young girls and start them on the engineering path early. Mrs. Braselton, who's engineering company currently has women as 24% of its workforce summarized all of these options by saying, "I don't feel affirmative action is a good way to fix the ratio issue. I believe that the most qualified applicants should be hired and promoted. In my opinion the better solution would be to figure out how to get more females enrolled in engineering courses in college. I think programs like ACE and IGED help to expose girls to the field and help diminish the stereotype that an engineer is a "male" job which gets more females enrolled in engineering courses". After conducting the research necessary for this paper, I now agree with Mrs. Braselton. At this point in history, affirmative action will do more harm than it will help because modern society has moved passed the point where they believe something like that is necessary. The best way to create a truly level playing field for men and women in STEM careers is to prevent them the same learning options when they are children. Parents and teachers need to encourage boys and girls equally to get into science and math so they can further pursue those interests in high school and college rather than letting them diminish. Beyond this, high school teachers and college professor must take the necessary steps to make their classrooms more accessible to all students so females are not pushed out due to the environment. As a girl currently enrolled in two engineering classes, I can say that until this year no attempt

has been made to make the classroom "female friendly". While this never really bothered me, I did on occasion feel that my male classmates were dominating the learning space and that my thinking was inferior. Ideally with some work, early and continued encouragement can eventually level the ratios between men and women in the engineering field.

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