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An Analysis of Gendered Outreach Messages on the Engineer Girl Website: How Female Engineers Promote Engineering to Young Women

Dr. Emily Gwen Blosser, University of Louisiana at Lafayette

Dr. Emily Blosser is an Assistant Professor of Sociology at the University of Louisiana at Lafayette. She has a Bachelor of Arts in German from the University of Texas and a Master of Public Affairs from the LBJ School of Public Affairs and a Master of Arts in Russian, East European, and Eurasian Studies from the University of Texas at Austin. She holds a Ph.D. in Sociology from Louisiana State University. She is interested in collaborative research between engineering education scholars and social scientists that focuses on the processes through which inequalities are enacted, reproduced, and/or challenged in various educational contexts.

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Introduction

Women's underrepresentation in engineering in the United States has been an ongoing area of concern to engineering educators and administrators [1], [2]. Despite the fact that women now earn more undergraduate degrees than men, and girls now perform as well as boys in math and science, young women make up approximately 21.9 percent of undergraduate engineering majors [3].

Efforts aimed at persuading girls and young women to pursue engineering include increased science, technology, engineering and math (STEM) extracurricular activities in schools, media campaigns to raise awareness and the development of new science and technology toys designed for girls and young women [4], [5]. Recruiting young women to engineering, however, is not without challenges. Engineering is often perceived of as a traditionally masculine occupation that is unwelcoming to women [6], [7]. Studies also regularly find that women in engineering encounter discrimination, difficulties cultivating a sense of belonging and obstacles to balancing work and family [2], [8].

To date, little research has examined messages present in outreach and media to understand how organizations attempt to appeal to young women and encourage them to enter engineering given these gendered barriers. This article attempts to redress this omission by analyzing profiles of female engineers from the website, Engineer Girl [4]. Engineer Girl is designed and maintained by the National Academy of Engineering (NAE) to inspire young women to become engineers. The main research questions I deal with in this paper are:

1. How do female engineers on the website describe challenges they face as engineers to potential newcomers?
2. What types of advice and career guidance do female engineers provide to young women as a way to succeed in engineering?

In what follows in this article, I first provide some background literature and describe the research project's theoretical foundations. I draw on sociological frameworks on gendering practices, as well as insights from feminist scholars with respect to postfeminist ideologies and how they shape women's perceptions of success in the workplace. I then describe the methods and the process used to do the research and then present the findings. Finally I provide my conclusions with questions for further research.

Background Literature

Women's underrepresentation in engineering

Diversifying engineering to include more women is a goal of most universities, workplaces and national science bodies [1], [5]. A wealth of research demonstrates that many women in the United States are well prepared to enter engineering as evidenced by their grades and coursework, but often select other college majors [7], [9]. Women may determine that engineering is not an appropriate career choice for them, not necessarily because they dislike math or science per se, but because they believe the work to be affiliated with traits that are culturally coded as masculine and thus incongruent with their own strengths and identities [6], [9]–[11]. Some research also finds that women believe that engineering requires one to have a certain level of brilliance or genius. Dominant cultural beliefs are less likely to ascribe such skills to women as compared to men, which may lead women to select other fields [7], [12]. Studies also regularly indicate systemic gendered barriers exist in engineering for women. Women in engineering encounter discrimination and difficulties cultivating a sense of belonging. Additionally, balancing family and an engineering career can also be a challenge. When considering possible STEM majors, women may avoid fields like engineering because of their belief that the climate is one that is discriminatory towards women.
[8], [10], [11][13].

Websites and outreach programs designed for young women often recognize they must confront women's negative perceptions of engineering [14], [15]. Scholars such as Sapna Cheryan and colleagues have argued for the need for new messages to persuade women to consider fields such as engineering [7], [9]. Cheryan contends that women would be more likely to select engineering majors if there was more messaging about how different and diverse types of people can succeed in the field, and if the diversity of the work was emphasized [7], [9]. Similarly, the NAE, which is responsible for the Engineer Girl website, has reported on the need to provide richer, more focused messages about engineering to make it more appealing to young people, particularly women. In one report titled, "Changing the Conversation: Messages for Improving the Public Understanding of Engineering" they advocate the need for new and improved messages to persuade girls and underrepresented minorities to consider engineer as a career choice. According to the report, new messages about engineering should communicate that engineers can make a difference in people's lives, that engineers are creative problem solvers, that engineers help shape the future and that engineering is essential to our health and happiness [16]. According to language on the Engineer Girl website, the site hopes to encourage more women and "is designed to bring national attention to the exciting opportunities that engineering represents for girls and women."

Media, Outreach and Engineering

A small body of literature examines how media communicate messages to women about educational and career prospects in STEM. According to one study by dePillis and dePillis, the authors find that engineering education websites depict engineering as masculine and authoritarian, even if they are not aware of this. In their research, a sample of undergraduate students read the mission statements from various liberal arts and engineering colleges and then

ranked the qualities that a hypothetical person would need to succeed in each one. Results found that students believed that a person who possessed so called "masculine" traits (labeled as: masculine, authoritarian, dominant and forceful) is more suited to engineering programs. Furthermore, male students were more likely to say that successful engineering students were more like themselves than female students were [17]. Other researchers, such as Jocelyn Steinke, have examined STEM websites designed for young women. In one study she conducted of 27 sites, she found that most of them show relatable role models and provide in depth information about science and technology to spark young women's interests in STEM [18].

Other scholars have also used qualitative methods to explore outreach programs for young women [14], [15]. In their analysis of one program designed for young women, Bystydzienski and Brown find that participants were informed about the benefits of engineering from companies and educators, but that some expressed skepticism about whether they would fit into the profession. Another key finding from this study is that gender is prevalent in such campaigns, as women are often encouraged to pursue areas of engineering deemed gender appropriate (i.e. more social than technical). Others have questioned whether outreach campaigns designed to recruit underrepresented groups have a tendency to make gendered distinctions between men and women, and point to the ways in which gender stereotypes drive such messages [19]. Such studies are limited and demonstrate the need for more scrutiny of how organizations and media shape messages for prospective female students.

Theoretical Frameworks

Feminist scholars who study gender relations point to the need to understand the gendered work experiences of men and women. Scholars have theorized the idea of the gendered organization to understand how workplaces and organizations that may appear to be gender neutral actually maintain gender inequality. As these scholars argue, jobs, job duties and organizations themselves have gendered expectations built into them that can present certain challenges for workers depending on their sex category [20].

The concept of gendering practices is another related idea, which refers to ways in which a set of gender knowledge is used by individuals to perform masculinities or femininities to gain acceptance at work [19], [21]. Gendering practices can exist in many professional spheres and vary by context. Cottingham for example has demonstrated how organizations mobilize 'particular aspects of culturally idealized masculinities' in media messages to persuade men to become nurses. In her analysis, she describes how organizations use varied gendering practices in outreach. She finds that organizations promote nursing as a "feminine" helping profession to men, but then emphasize the ways that nurses can also be "masculine" by earning a lot of money and thus fulfilling a traditional breadwinner/provider role [19].

In another study on female undertakers, Scott-Pruitt studies women's experiences in this male-dominated field. She emphasizes gendering practices by showing how women navigate gender stereotypes with respect to the job. For example, she finds that female undertakers face sexism when clients doubt they can do parts of the job, such as picking up and transporting dead bodies in a hearse. However, her respondents also talked about having certain advantages, when they asserted their "femininity" to counsel and interact with grieving families [22].

As those who have researched women in STEM demonstrate, women often face unique difficulties in these male-dominated and male-identified professions. Studies find that women must engage in certain practices and behaviors in order to prove that they are competent and professional members of the profession. For example, in one study by Heather Dryburgh, she finds that female engineering students learn to adapt to engineering culture by accepting sexism, working hard in order to prove their competence, and by performing masculine behaviors, such as acting tough. As she argues, this adds a layer of extra work for women who must learn to present a confident image to be taken seriously as an engineer. Dryburgh describes how women must work to manage others' expectations of them and they do this on top of taking courses in a demanding curriculum [23].

Through interviews with women in STEM, Rhoton also finds that female scientists often deny sexism and attempt to distance themselves from "feminine" behaviors. She describes how her respondents distance themselves from women who show emotions or get "overly" sensitive about criticism or sexist practices. Rhoton finds that female scientists do this to gain acceptance in professions that prize objectivity and rationality [21]. As she explains, professional socialization into scientific cultures encourages and rewards certain gender practices. In another recent study, Seron and colleagues analyzed how many female engineering students are not willing to adopt a feminist perspective on policies designed to mitigate the historical legacies of sexism in engineering. As the authors find, women in engineering in their study were aware of their token status and their marginalization, but were socialized into ways of thinking that justified the existing arrangements. Women come to believe that the system that rewards men and masculinities in engineering is fair and just [24].

Another important framework that sheds light on women's experiences in the workplace is postfeminism. Postfeminism refers to a dominant set of cultural discourses around gender that circulates certain ideas, images, and meanings [25], [26]. Postfeminist discourses celebrate past feminist successes often assuming that most obstacles to gender advancement have been eliminated. Any gender discrimination that does still exist is often minimized and now perceived of something that can easily be managed or overcome if women work hard enough. Much of the postfeminist rhetoric promotes a can-do type of woman who has now become an active agent rather than a passive subject. This means that women must engage in forms of self-work and adopt certain behavioral modifications (being confident, happy and positive are key mechanisms) to find success. Rather than addressing systemic issues or structural gendered barriers, postfeminism invokes the language of feminism (i.e. that women should be empowered and have opportunities) to position individuals as responsible for their fate. Postfeminism circulates heavily in the media and can be described as a sort of ideology or "sensibility" that shapes how the public understands women's lives and experiences [25], [26].

In this vein, scholars Gill and Orgad have emphasized the emergence of a what they term a "confidence (cult)ure." As they explain, confidence has become a new gendered technology of the self that is marketed to women who are now encouraged to be confident as a way to get ahead [27]. Gill and Orgad argue that this ideology is often referenced to help women manage issues primarily related to parenting, work and their appearance. As just one example, they reference a famous TedTalk by psychologist, Amy Cuddy. In her talk Cuddy describes how

women can use power poses to assert their power and dominance, focusing heavily on behavioral interventions as the key to women's success. As Gil and Orgad argue, "Academics and think tanks, politicians and newspaper columnists, call on women to recognise that they are being held back not by patriarchal capitalism or institutionalised sexism, but by their own lack of confidence – a lack that, as we will show, is presented as being entirely an individual and personal matter, unconnected to structural inequalities or cultural forces (pg. 4)."

Others such as Adamson and Kelan have shown how celebrity businesswomen draw heavily on postfeminism to encourage women to use confidence, control and courage to redress the under-representation of women in management and leadership [28]. As these authors point out, such discourses depict the process of overcoming challenges and particularly gendered challenges, as one that is highly personal. They note how successful businesswomen promote narratives that overlook deeper structural issues that impact women, such as a lack of affordable and available children or pervasive discrimination by superiors and coworkers [28].

Few studies in engineering education research have considered how media present messages to young women and rarely do studies use theoretical frameworks that emphasize how women promote certain gendering practices to newcomers or aspiring engineers.

Sample and Methodology

To conduct the research for this article, I used constructivist grounded theory, which is a qualitative inductive methodology developed by Cathy Charmaz [29]. Grounded theory is a method that uses systematic but flexible guidelines to collect data often through interviews or the analysis of texts. The researcher then analyzes data through coding and memo-writing. The goal of this method is to develop theories or provide new insights into social phenomena. Constructivist grounded theory recognizes that multiple perspectives and social realities exist and promotes ongoing analysis and an openness to emerging ideas. Charmaz's method also acknowledges that the researcher plays an active role in the research. As she explains, the results must be firmly grounded in the data, however, the researcher and the research participants are not external to the process. For example, researchers determine which questions to ask of respondents or which elements of respondents' stories are compelling as they engage in coding and analysis. Furthermore, participants determine which stories and information they share with the researcher and use certain types of rhetoric to express their feelings and experiences [29]. According to Charmaz, researchers need to go beyond the surface in seeking meaning in the data. She advises researchers not to simply describe data or take it at face value, but to look for and question tacit meanings participants provide about values, beliefs, and ideologies.

To create a sample to analyze, I relied on one section of the Engineer Girl website titled "I'm an Engineer," which contains profiles that practicing female engineers submit. Any female engineer can submit information about themselves and their jobs to the website so that young women can get insight from potential role models in the field. Women answer structured questions and submit two pictures of themselves. The online form on the website asks women to respond to the following prompts:

1. What I do-Describe what you do in your current position.

2. Why Engineering-Why did you choose engineering?
3. School Days-Where did you go to school and what degree do you have?
4. My Day at Work-What kinds of activities have typically been part of your work?
5. Best Part-What do you like best about being an engineer?
6. Proud Moments-Which of your career accomplishments are you the proudest of?
7. Challenges-What challenges have you met and conquered in your pursuit of an engineering career?
8. My Family-Please tell us a little about your family.
9. Dreams and Goals-What are your short-term (1-2 years) and long-term (10+ years) goals?
10. Inspiration-What (or who) had/has the greatest influence on your life?
11. Want to be an Engineer-What advice would you give to a young woman considering a career in engineering?
12. Hobbies-Describe something about your life outside of work: your hobbies, or perhaps a favorite book.
13. Short bio-Please add a short bio that would be understandable by middle school students. Feel free to add anything else about yourself that is not covered in the questions above.

The website asks women to provide answers for at least five of these prompts. Some women provide more detail than others in their responses and not all of them answer every question. There is also a wide range of jobs and engineering fields these women are involved in. Women profiled on the site live all over the US and the world and work in a variety of companies and organizations. Some of them have a bachelor's degree, while others have PhDs and hold academic positions at universities. Some have years of work experience while others are just embarking on their career.

I did not use all the biographies or profiles on the site but instead created a sample of 192 women available on the site. I excluded the profiles of women who only provided information about where they went to school, or what they studied and where they worked because they did not have any advice or information that I could code. I decided to exclude any women who lived, worked and were educated abroad since the international context and educational systems might be different and thus hard to compare to women in the United States. I included a total of 192 profiles of women in my sample for analysis.

Websites undergo changes and new profiles are added on a regular basis to Engineer Girl. For this reason, I began the analysis of the website at the end of December 2020 and completed it at the end of February 2021. New profiles are added regularly and I stopped analyzing available profiles in the last week of February.

It is also worth pointing out here that this type of analysis is unable to determine how many women use the site or how women relate to the information on the site. The point of this study is to analyze the messages themselves. A website of this nature, maintained by an influential organization such as the National Academy of Engineering, offers valuable insight into the types of stories women tell about engineering and the way that prominent organizations promote those

stories in the media. In a sense, such websites act as the public face or a prominent symbol of the profession in the US.

In order to code the interviews, I followed the coding process outlined by Charmaz, which uses three main steps of coding. In the first step I began by using an inductive process to analyze interviews. In the first step of coding, I read through each woman's profile on the website line by line and created labels or brief sentences to categorize the data. I did not have any preconceived categories, but I was particularly interested in understanding how these women "marketed" engineering to young women, given the masculine connotations of the field and the well documented gendered barriers that women face.

Initial coding generally relies on using gerunds or short phrases to capture the ideas from the data and attempts to stay close to the data. In this process, I labeled and categorized the texts found on each profile. Examples of codes included phrases such as: Having to prove your worth as a woman, or never letting anyone tell you can't do it, finding mentors to help you realize your dreams or knowing you are making a difference creating something. This step generated a large number of gerund descriptors and I took handwritten and typed notes for each woman's profile describing what was happening in the data.

In the second step of focused coding, I began comparing and contrasting the descriptive gerunds and phrases I used in initial coding to devise more focused coding categories. In this step I designated two main coding categories that I labeled gendered barriers and non-gendered barriers. The first contained any obstacles women mentioned they faced because they were women or due to gender stereotypes, the second had to do with any other challenges they mentioned in general. I then also created specific codes related to the types of advice women gave to young women to be successful. This was often given in response to the barriers they faced. I eventually came up with two main types of advice titled: minimizing and reframing barriers and taking proactive steps. I also created a third code titled: convincing women engineering is a good job to conceptualize the idea that women in engineering work to persuade women to see the good as well as the bad.

In the third step of coding I utilized memo writing to make sense of coding categories I created. I was familiar with postfeminism and the literature on gender and work before performing this study, but I did not start coding with these frameworks in mind. It was in the memo-writing process that I began to link my findings back to postfeminist theories and frameworks regarding gender and work and tie themes together. Throughout the process, I was struck by the fact that practicing engineers on the site describe how they love their jobs, but are very vocal about the fact that they face barriers because they are women and that engineering is a difficult and demanding profession. Furthermore, young women are encouraged to use individual strategies that often focus on cultivating a confident subjectivity and engaging in hard work to overcome barriers in engineering. While such advice may seem to progressive, in many ways it contributes to the maintenance of gender inequalities in engineering.

Below I provide three sections where I describe the various barriers women face (gendered and non-gendered), the types of advice women give (minimizing and reframing and engaging in

proactive work), and a short discussion of another main theme about why engineering is good for career for women.

Barriers

Gendered Barriers

A main theme in the coding process was that women will face barriers in engineering. Approximately 40 percent of the women in my sample mentioned some type of gendered barrier they encountered. These women discuss various challenges they faced as women and inform young women of the fact that they might encounter these issues as well.

In my coding of gendered barriers, I included anything that women mentioned with regards to challenges or problems they faced because they were female engineers or that related to gender bias or stereotypes. Women expressed gendered barriers in many different ways and there were a number of different types of comments. Some of the most common barriers women mentioned included: Being a female in very male dominated field, facing discrimination and stereotypes, having to prove one's abilities to others, not being taken seriously, not being treated well or promoted professionally and having difficulties balancing career and family.

One common sentiment several women wrote about in their profiles, dealt with the frustration they experienced because they were one of a few women in engineering profession. As Karina described it,

> "My senior year of college was one of the most challenging experiences I had in my pursuit of becoming an engineer. I was in a senior design class with 25 males and only 2 female engineers. I was in a team of 6 and it took us a few months to learn to work together effectively. Many of them had strong personalities and wanted to take over the entire project themselves, so the biggest challenge for me was finding my own space on the team to contribute."

Women also discussed having to prove themselves. As Nafisi explains,

> "I had many people tell me I couldn't do it and I did face some sexism while pursuing my engineering degree. So proving to everyone that I was capable was a great feeling."

In a similar vein another woman tells readers,

> "The challenges I've met and conquered are similar, if not identical, to the challenges every woman engineer may face at one point in their career. One of my challenges was having to prove myself, my ability, and role."

Facing stereotypes about women's suitability for engineering was another type of barrier some women mentioned. While many women usually write a short sentence making their point, one woman, Sreyoshi, explained her experiences in more detail,

> "Since I had not experienced gendered roles at home, stereotypes and societal norms of the real world stood out as a stark contrast when I chose to step into engineering. I have faced these in small but aggravatingly plentiful doses of varied forms – sometimes guised as concern about how a girl could possibly choose to pursue the very outdoorsy and thereby "manly" field of Mechanical Engineering, or questions on why I wasn't better using the "feminine" traits of my personality towards pursuing something like teaching or communication which was more appropriate for girls like me, or in hardly finding role-models since engineering women who look like me are very few in leadership positions across academia or industry."

Another respondent, Rae Anne simply made a list of the challenges she faced to warn women about what potentially awaits them. She stated the following about problems she had had,

1. Under paid with respect to my male peers.
2. Not given proper leadership roles with respect to my male peers.
3. Hitting the pay and responsibility "ceiling" at age 40 in my industry as a professional woman engineer.
4. This is a field dominated by males. Don't be naive or surprised when you arrive and find that men sometimes misbehave.

There were also women who discussed how they had difficulties balancing work and family. One woman named Rachel tells readers in a short sentence that she struggled with,

> "Staying competitive in the field and taking advantages of upward career potential while raising 4 young children."

Another woman explained her challenges in managing her professional and family life,

> "I spent many years at home raising my two sons. It was a huge challenge to come back to the workplace and have to learn about the latest technology. As much as I hate to say it, I believe there may be an unconscious bias against women in engineering that can be a stumbling block when it comes to recognition and promotion."

As these two quotes above demonstrate, women on the site discuss that they struggled with staying up to date in terms of their technical knowledge and ability to perform their jobs as engineers while also being mothers.

Non-Gendered Barriers

Women on the site also discussed other challenges they faced often without specifically mentioning gender or their identities as women. This is not to say that gender did not necessarily play a role, but that women did not mention their identities as women or gender as directly related to such obstacles. Approximately 43 percent of the female engineers explained to young women that they could expect to face other difficulties in the profession. The most common challenges discussed were as follows: that engineering is a difficult and demanding job/major that is time intensive and competitive, that engineers have to be prepared to fail and make

mistakes and that learning how to communicate effectively with clients and team members is difficult.

Difficult academic coursework and material is one topic that many women describe. A frequent follow up is that young women should not be discouraged by poor grades in math in science. For example, Kallyani talks about grades, discussing how women may get discouraged if they do not excel in their coursework. She tells women,

> "You don't have to always score an A in math and science to be a good engineer. Believe in yourself and pursue engineering."

Another woman explained the following,

> "Don't be discouraged from exploring an interest in engineering if you aren't getting good grades in your math and science classes! Being "good" at those subjects will come with time if you challenge yourself to always ask questions whenever you're confused or curious about something."

A second obstacle that women bring up relates to how they had to overcome fear because the profession is difficult. As Kathy explains,

> "One challenge I conquered was overcoming fear. As a young engineer, I lacked confidence. Over time, and because I was **really** interested in and passionate about learning new things, I overcame fear by reading, studying and thinking through various problems and designs. At times, it was as simple as talking to colleagues and then putting two and two together. Other times, I figured it out on my own. The times I learned it on my own were more rewarding (and more respectful of my colleagues' time!). Gaining the knowledge made me more confident in meetings and while working on my assignments. Eventually, I mastered my specialties and it became time to move into a leadership role.

Learning how to fail was another common theme as women often expressed the idea that if they had problems, they had to learn how to deal with them. As Erin tells women,

> "I'm a little bit of a perfectionist so learning how to fail was really hard but I am SO glad I've become comfortable with it."

In terms of communication, women expressed different ideas, often referencing that it was difficult to express technical ideas or that engineering required a lot of communication so one had to master this. At times such comments took on a gendered nature, indicating that a dominant or confident style was necessary for success. According to one woman on the site,

> "The biggest challenge for me has always been my own personality. I am quiet by nature. I tend to keep to myself and let others speak instead. I finally have come to a point in my career where I understand that being an engineer, being intelligent, being practical, and getting respect and appreciation that I know I deserve... only happens if I can communicate my ideas to other people, to an audience, comfortably and confidently. I

> have to break out of my shell, step out of my comfort zone, put on my hard hat and throw myself forward full force. Sometimes it's easy. Sometimes it's not. That's life."

Throughout the website, women present engineering to young women girls in ways that create impressions of a job that will be difficult and that will take a lot of hard work.

Postfeminist Advice

Women provide advice on the website in response to the issues presented above. Such advice is strongly reflective of a postfeminist sensibility. This is not to say that the women on the site identity personally with postfeminism as a philosophy or are even aware of it. The advice they provide, however, aligns with dominant postfeminist narratives and cultural ideas about how women can achieve success in the contemporary workplace. They emphasize the need for women to overcome any other issues or obstacles they may encounter as individuals (whether or not they perceive of them as being related to gender). Women on the site promote the idea of a 'can-do' woman who takes control of the situation and is confident.

Minimizing and Reframing

One common piece of advice to women often with respect to gendered barriers was to minimize their importance or ignore them. For example, one woman on the site asserted,

> "I have learned that being the only woman in a meeting simply does not matter at all. My voice matters just as much as anyone else's."

As another example, another woman named Varsha explains to her audience that women should do engineering. To motive women she tells them,

> "Go for it. If you are good at your job and show an aptitude for engineering, nothing should stop you from achieving your goals. Be prepared to meet some obstacles. But if you ignore the fact that you don't meet the stereotype of a typical engineer, others will be forced to ignore it too."

According to Varsha as long as you perform well as an individual and you do not acknowledge the stereotypes that are endemic in engineering workplaces, then other people will also forget them.

Minimizing often included denying there were problems or blaming women for getting upset about them. For example, sometimes respondents even chided young women to change their perspective on the difficulties or the challenges, blaming them for simply not wanting to do something difficult. One woman said the following when telling women to try engineering,

> "Go for it! But I won't sugar-coat the work involved. Many girls look at engineering as "too hard". It's not too hard. It just takes more time, dedication and perseverance to learn what you need to know vs. an "easier" career."

Another expressed to women their need to let go of perfectionism. As she advised,

> “Engineering is about trial and error. Too often girls and women feel the need to "be perfect". Mistakes happen when you experiment and is part of the process, and mistakes are ok!”

Reframing gendered barriers as something that an individual woman could overcome was also common. As one engineer recalls, if women can see the ideas others have about them in a different light, they can get past them. In the words of one female engineer,

> “Most of the challenges are conquering "expectations" other people have for you. When I decided to pursue my advanced degrees, some people close to me commented that it seemed pointless since I would be "quitting to have children soon.”

According to this, even when coworkers or supervisors are biased against women or discriminate against them, women themselves must overcome this by conquering those expectations, presumably by proving them wrong or blowing them off.

In yet another interview, Maja explains how gendered barriers are simply an uncomfortable part of the job and seeks to minimize them, telling women that they have to find new ways to navigate the situation. As she writes in her profile,

> “Any worthwhile pursuit is full of challenges. Like everyone else, I meet challenges every day. The world has its share of sexist people, racist people, negative people, insecure people, and lazy people, and those people get in everyone's way and can make things difficult. They never go away, no matter how successful, senior, and established a person is, there are such people to be found. So, it is important to do three things: 1) work on meaningful things; which will result in 2) believing in yourself; and 3) having good people you can talk to and work with. Focus on what's worth doing and ignore the rest. Don't expect things to get easy, because life is not about things being easy, it's about things being meaningful.”

According to Maya, while she acknowledges discrimination, she frames it as something that women can manage. If women can just find meaning it will be easy to move forward regardless of such issues. Similar to previous quotes she urges women to ignore it.

Another woman on the site simply laughs off the discrimination providing the following anecdote,

> “Throughout my career as an engineer I have always been in the minority and have often faced discrimination as a woman. I had to develop a strong sense of self to deal with others perceptions of my capabilities and my strong sense of humor when faced with ridiculous (and humiliating) scenarios helped me persevere. My motto was always, ‘if you underestimate me, you deserve what you get.’ It served me well.”

Even when women spoke about non-gendered barriers, such as the difficult engineering curriculum, most insisted that women change their attitude or use a new lens to view the problem. Kallyani, discusses how shocked she was when her grades dropped and again explains to women how they can think about this experience differently on an individual level. She tells women,

> "I would say to never let a bad grade or experience make you think that you are unable to pursue your passion. Everyone has hard days, and it's how you respond and grow in those moments that define the kind of engineer you will be."

All of these statements are reflective of what Gill and Orgad point out about the rise of postfeminism as a dominant discourse among women in the workforce. As these scholars argue, any issues that women encounter can be easily overcome by behavioral modifications or changes in attitude (often through confidence) that individual women must make to themselves [27].

Proactive Work

Beyond simply changing one's attitude towards barriers, engineers on the site also regularly counseled young women to take proactive steps as a way to cope with issues they were likely to encounter. Young women learn about the many things *they* can do to improve their experiences and get ahead. Women are told to seek out opportunities, join clubs, do extracurricular activities and find mentors. Furthermore, much of the rhetoric assures women to simply believe in themselves and be confident.

As an example, one female engineer's advice below is illustrative of what women need to be doing. As she puts it,

> "Explore your interests, pursue a wide range of opportunities so that they enable you to find what you love. Resist being siloed and seek out multi-disciplinary projects with diverse individuals and learn to contribute to these with your unique perspectives and voice. I urge them to persist and to do and be the best that they can."

She even continues by explaining that if women do this, they will become more confident and more assured and this can help counter any gender discrimination. Here, young women are given a laundry list of steps they can take to succeed in order to overcome the perceptions people have that they are not suited to this career.

In another profile, a woman named Marjory explains her fear of not being able to do a new engineering job she was hired for and tells the reader how she handled it primarily by working on her own self confidence and doing all of the things she needed to do to excel. As she states,

> "When I started my job at AOC, I was nervous about the engineering work. This was my first exposure to such work and I had always believed I wasn't smart enough to be an engineer due to my difficulty in math and science. However, I faced my fear, participated on every project team to which I was assigned, and eventually learned to read blueprints and plans allowing me to perform the work for which I was hired. Some people even said

> I couldn’t do it, that I would quit the job because I didn’t have an engineering background. I proved them all wrong.”

As this statement indicates, Marjory explains that even though women are so often doubted in engineering, it was ultimately up to her to fend off her critics and to go the extra mile to counteract any discrimination.

Another very common piece of advice that I coded in this category was the encouragement of women to find mentors to help ease the transition to male dominated field or to assist and aid them with the difficult curriculum. One woman, Vanessa writes,

> “Being a female, and looking younger than I am always presents challenges when I start at a new company. People don't know my level of expertise by looking at me, but they learn eventually. I had wonderful mentors, male and female, who have taught how to seize the moments and opportunities to further my career. It takes confidence in yourself.”

Another woman explains how she came to understand how necessary mentors were once she confronted obstacles. As she puts it,

> “I never really took the resistance to women in engineering, seriously, until I was actually working in the profession. There was hostility, actually public humiliation, on campus when I was in school, both from students and from professors and teachers. Fortunately, I had a wonderful role model and mentor in one of the mechanical engineering professors, Dr. Lois Graham.”

As these quotes demonstrate when women do run into challenges, they are in control of the situation and may find others like them or locate mentors (often other women, although some mention finding male mentors) who will help support them.

Engineering as Good Career for Women

Despite the fact that female engineers use messages on the website as way to warn young women about obstacles, women spend a lot of time promoting the idea that engineering is a career that is rewarding and ultimately good for women.

The engineers on the site are also are quite enthusiastic about how much they enjoy their job and provide many reasons women should try the profession. Women describe how it is intellectually rewarding, offers a wide range of possibilities professionally, allows them to work with others and is a helping profession. On this website another consistent message for women is that they should consider it because it is a well-paid career.

As one woman tells young women readers,

> “Once you complete your degree, you will find job opportunities to do what you love to do and make money at the same time - how cool is that? There is nothing more satisfying

> than knowing you provided a solution to a problem that helped another person/community because you engineered your way through it! There is always room for one more engineer, let it be you!"

This woman's statement aligns with need to go beyond promoting the idea that engineers simply use math and science. She explains how engineering is a profession that can encompass larger professional goals such as changing the world and helping people.

Another woman challenges the idea that engineers sit at desks or that they are focused on narrow problems, by saying the following,

> "You can do it! I think many young women don't think this a profession for them whether it is due to the challenging coursework or the perception that engineers only sit at desks all day and don't work with people. The engineering profession has endless possibilities of the type of work that you do as well as the type of products. If you like to solve tough problems and make improvements, this is an excellent field for you."

Additionally, women on the site hope to encourage young women to see engineering as a job that does not conform to common stereotypes. As Amy puts it,

> "One of the challenges that I have faced was learning that engineering is not about 1s and 0s. Engineering is a people discipline. So many of the stereotypes do not accurately portray what an engineer does. I spend more of my time communicating with others and seeking to understand than I do coding. And I firmly believe that's the way to a successful project. Anyone can write code. But it takes a lot of effort to understand what that code is supposed to do and why."

The pictures on the website also work to shift stereotypes about women in engineering as tomboys or isolated in a lab or office. Women on the website present an appealing and diverse image of women in engineering. Many photos show them with their partners, children or other family members. Some show them actively engaged in fun activities such as skydiving or one image where a woman is riding a camel.

Another interesting point that some women make, is to tell young women interested in math and science they should consider engineering because they may bring something special to it because they have a different perspective.

As Arielle explains,

> "Finally, own the fact that you are not like anyone else or like the men in your field. That is a positive and think of it and communicate it as such. No one thinks like you and that is a great thing. Your uniqueness is a benefit to the community. We think sometimes that we need to be more like our male counterparts or think or act like them. We don't. We need to think and act like ourselves. That is our superpower."

In many of the profiles women provide, they are keen to point out that engineering has a lot to offer women on many levels, if they are willing to consider it. They also promoted narratives that engineering encompasses more than math and science and can be used for making the world a better place and that engineers work with people. Such messages do vary from dominant discourses among engineering educators and even stereotypes about what engineering is [7][16][30]. They may be able to change young women's ideas of the profession by showing a diverse group of women in the field who discuss how much they enjoy their work and the wide range of work they perform.

Discussion and Conclusion

In this analysis of the Engineer Girl website, I found that female engineers who submitted information to share with young prospective newcomers to engineering express their satisfaction and enjoyment of engineering. However, they describe engineering as a gendered profession that requires certain gendering practices to be successful. Women voice their frustrations with discrimination and gendered obstacles they encounter in the profession. Women talk about the fact that they do not receive the same opportunities as their male counterparts and are treated differently because they are women. They also regularly inform women that engineering is a challenging and demanding field for an many other reasons that often do not reference gender.
.
In terms of the advice they give, few of them suggest that workplaces, educational institutions or the engineering profession should change in response to their concerns. In fact, most women on the site prime young women for the status quo and suggest that they should learn to cope with these issues as individuals. Positive affirmations are also sprinkled in throughout the profiles with expressions such as "go for it," "don't let it get to you" and "you can do it."

Much of the advice given to women takes a postfeminist tone by suggesting that young women minimize discrimination or see setbacks through a different lens. The advice also emphasizes steps women can take to succeed in engineering, such as doing extra work, joining organizations and seeking out mentors. While this is likely meant to be encouraging to women, it is important to contextualize such advice. It places a lot of pressure on women, without ever considering what might need to change for women in engineering.

As scholars such as Dryburgh maintain, when students learn how to become professional engineers, gendered differences are present and can be particularly difficult for women. In her study she finds that women begin with the so called "handicap" of being female in field where a male identity confers a level of competence. This speaks to women's need to have to perform extra work to find success [23]. As Dryburgh writes,

> "Learning to present a confident image is part of the professionalization process for both men and women. It is learned, in part at least, to mask the anxieties associated with the work hard culture of engineering. For women, however, the anxiety is increased by fears concerning their future acceptance by older male engineers in industry and the public (pg. 674)."

Additionally, advice that is rooted in confidence can have implications for women who may feel they must uphold practices of masculinity, such as being tough and persevering and not showing weakness. This is not to say women should be told to give up, or that they should not be encouraged to persist if they face discrimination or do not receive good grades. However, we might also consider why such advice appears to be so relentlessly targeted towards women and consider that it locates the blame for women's inequality in a field like engineering as one that is rooted in their own psyches. It lets engineering institutions entirely off the hook for such problems [27].

Stephen Secules and colleagues have discussed the potential for critical theorizing to process one's marginalization in engineering, which could be interesting for women in engineering and the Engineer Girl website [31]. As outlined in an excellent paper published in the *Journal of Engineering Education*, Secules and colleagues detail his conversations with an undergraduate engineering student named Emilia, who described the barriers she faced as a female student in engineering. For example, Emilia talked about her struggles with math, but points out that it was result of inadequate preparation rather than any kind of innate shortcomings because she is a woman (the latter explanation is often a dominant cultural narrative). As the authors argued, this was liberating for Emilia, because few conversations like this transpire in the engineering education setting [31]. Secules and colleagues point to the idea that minorities in engineering might benefit from having a chance to express their frustrations honestly and to question the system or the way things have always been done. On the Engineer Girl website, most women identified challenges in a similar way to Emilia, but they overwhelmingly fell back on familiar notions about how women should turn the other cheek or prove those who doubt them wrong, rather than scrutinizing the system or giving voice to the idea that there were underlying problems with engineering cultures. Indeed, the stories told on the Engineer Girl website suggest that a process begins early in engineering education, whereby young women are taught to accept a system that will marginalize them and to their best to survive and overcome it.

I think it is very important to point out that this paper is not meant to be a critique of these women and the success they have found, nor is it meant to disparage the advice they are providing. The actions and behaviors they recommend have helped them to be successful in navigating workplaces and educational systems that have posed obstacles. These women are responding to hierarchical and gendered power structures. It would be impossible, for any individual woman to change the system. Furthermore, the rhetoric they use *is* moving and inspiring [27]. Nevertheless, it is problematic because it leaves power structures that disadvantage women in engineering unexamined and largely invisible. The implication of such rhetoric is that institutions and companies do not need to change to address the underrepresentation of women, but rather that young women need to change to become engineers.

This research raises questions for a few types of future analysis. First, it would be useful to explore the type of advice given to young men who might be interested in engineering and compare it to what is on this website. There are not as many similar types of websites for young men, but it would be fascinating to consider if men would be counseled in the same way. Would young men be told not to let anyone deter them from their dreams of being an engineer, or to

never be afraid. Would men be encouraged to boost their confidence? Would they need this kind of encouragement?

Additionally, it would be very interesting to do more research to explore how young women who use this site relate and react to these messages. Do women find it helpful to learn about the hardships they will encounter and how to confront them or do they feel overwhelmed? When they read about the possibility of gender discrimination, does this lead them to consider other professions in STEM or even certain fields in engineering that they believe might be more welcoming? At the same time, the women profiled are inspiring and tell interesting stories about the types of jobs they have. How do young women view this information? In my own research interviewing young women studying engineering, I have been told by some that they want more "honest" information about how to deal with sexism or balancing in work and family in the future, but often do not receive it in their educational careers. I also have heard from others that when they are given advice about how they will have to be "superwomen" to succeed in engineering they find it discouraging.

Finally, in closing further analysis could also be done to explore how race and ethnicity factors into such advice. This is extremely important but was unfortunately beyond the scope of this project.

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