SUSAN LORD—CUTTING TIES, FORGING PATHS, AND SPEAKING UP

I have had a successful career. My bio shows highlights including being an IEEE Fellow and receiving the IEEE Undergraduate Teaching Award for "*contributions to the development of more inclusive and innovative undergraduate teaching in electrical and computer engineering.*" I'd like to share some personal reflections about my journey from a Ph.D student researching molecular beam epitaxy (MBE) to inclusive teaching. A critical part of this story is being a woman. I went to graduate school because I wanted to teach. I was offered fellowships from the National Science Foundation (NSF) and the AT&T Bell Laboratories Graduate Research Program for Women (GRPW). I almost turned down the GRPW to avoid the "stigma" of a women's program. Fortunately, I recognized its advantages including having Dexter Johnston as a mentor. Active in EDS, he encouraged me to join and helped me learn to prioritize my efforts. I remember his advice "You can save the world or you can graduate." I bristled at the time but am glad I decided to focus and graduate. I can now use my voice to make a difference! I expected graduate school to be challenging technically and it was. However, I was unprepared for the messages that I did not belong as a woman. For example:

- I was the only woman in a group of about 25 men. I felt like I worked in a locker room including my peers calling our advisor "coach" and I needed to wear "armor" every day.

- Male friends in EE declared "there's all these unqualified women and minorities in EE at Stanford." When I worked up my courage to ask "Do you mean me?" they quickly replied "Oh no, not you, but there are all these others." When I asked who, they had no names. If I hadn't been there, would I have been lumped in with "all those others?"

- At the opening session of my first EDS Device Research Conference, one of the organizers cut his tie with scissors to demonstrate the informal atmosphere. I was shocked. As a woman, I was not wearing a tie and did not feel welcome.

I'm tenacious and had strong support from family and friends but I understand how such experiences led others to leave the field. Sexism and racism are not abstract concepts. They have been embodied in this culture. I knew that women were about 10% of EE graduate school. I didn't know that I would often be the only woman in the room or lab. Male students repeatedly asked me "what do women think?" So I took Feminist Studies courses. This opened my eyes to a different world. It never occurred to me that people studied topics such as gender roles or the gender pay gap. These classes gave me a language to discuss issues. I was discouraged from exploring Feminist Studies because my engineering colleagues thought that areas outside of engineering were useless. This attitude prevents many engineers from recognizing valuable expertise and collaborating. After decades of teaching, I finally found a way to integrate aspects of social responsibility into my Circuits class [1]. I could not

have done this without those feminist classes and collaborations with social scientists. My career has not been traditional. I've enjoyed combining things that others might consider separate including EE and Materials Science as an undergraduate, EE and Feminist Studies as a graduate student, and EE and engineering education research as a professor. I'm now leading an Integrated Engineering Department where we envision engineering as sociotechnical. I have forged my own path and had an impact beyond what I could have imagined when I was in graduate school. I chose to start my career at a teaching-focused university. And I loved it! I pivoted to engineering education research and have had an amazing community of support including local colleagues and a community of engineering education researchers in the IEEE Education Society and beyond. There are many paths to being a successful electrical engineer. Having been excluded as a woman, I strive to have all of my students feel included. The pain of exclusion led me to learn from disciplines outside of engineering which have helped me to be a better engineering professor. I believe that it is critically important to expand diversity and inclusion in IEEE and EDS. The rising awareness of systemic racism among White communities and the COVID-19 pandemic emphasize that business as usual is not sustainable. My research has shown that EE in the USA lags behind other engineering disciplines in the participation of women [2]–[4]. Many Black students are attracted to EE but do not graduate. EE must address these cultural problems with the same intellectual enthusiasm that we bring

to technical challenges. We need diverse perspectives because diverse teams produce better innovations and move towards social justice. It is not enough for those of us with different perspectives to be allowed in the room. We must be able to share our perspective, be heard, and supported. Those of us with privilege, in my case as a White person, must strive to be allies and use our privilege to support others. None of us are successful solely because of our own efforts. We need to learn from our own history of erasing or hiding contributions of women. Lynn Conway, a pioneer in microelectronics, waited 52 years for IBM to recognizes her contributions and apologize for firing her when she began a gender transition [5]. Katherine Johnson, a pioneer in space exploration at NASA, waited until she was almost 100 years old to be recognized for her mathematical contributions [6]. Advocating for positive cultural change shouldn't take decades. At this historical moment, women in engineering have an opportunity to change the culture if we are willing to speak up, not accept the status quo, and ally with others who experience marginalization. This will only succeed if men are willing to honestly listen, examine their own behaviors, and do things differently. I hope then that women can take off their armor and feel fully included in organizations like IEEE EDS.

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References

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