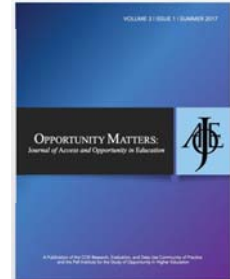


Making Room and Finding Place: Why I Stayed in STEM

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Abstract: *One of the challenges in the STEM fields (particularly in the hard sciences and engineering) has been retaining under-represented groups at the college and university level and later at the career level. In this personal reflection, a woman with both engineering and chemistry degrees describes why she persisted in the STEM fields and why she believes the individual decision to stay is key to changing the face of STEM.*

Keywords: STEM, Engineering, Under-represented Groups, Persistence, Culture

I was at a conference recently, and as I was waiting for my turn to speak, I started mentally calculating the time I had spent in my STEM career. The number of years seemed wrong; I stared at the ceiling—can't be right. I flipped over a flier and wrote the calculation out. The value was sound and amazing to me: 44 years. I never had any intention to enter science growing up; I hadn't even considered the possibility. Yet two engineering degrees, two science degrees, and 44 years of experience later, here I was speaking on increasing diversity in engineering, specifically increasing the participation of women in the engineering enterprise. But here's the kicker: I have been having this same conversation about women in engineering—and in the hard sciences—since I was 17 years old. Maybe I am impatient, but 44 years seems ample time to move the needle.

What is the problem? Why is diversifying parts of STEM so challenging? At this point, the academic in me should start citing studies about pre-college programming, recruitment efforts, special retention programs, career mentoring—all well and good, but in some sense, I think this is part of the problem. We view groups not currently participating in STEM as monolithic entities, as if women and people of color all have similar needs based on their group association. We do this because primarily we view the STEM enterprise as monolithic. The words *scientist* and *engineer* invoke classic caricatures in our minds, which are invariably white and male.

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It is true that, traditionally, the STEM enterprise in the US has been driven by the ideas and behavior of white males, and the conservative values of STEM have been narrowly and wrongly (I would argue) described as being steeped in scientific neutrality, logic, and intellectual fairness. Among STEM traditionalists, the entry of a person into STEM is an easy process: if you have the requisite talent (which is usually viewed as fixed), the inherent intellectual fairness of STEM will allow you to succeed. If you cannot succeed, then the flaw is yours, not that of STEM. In the traditionalist's mind, STEM is pure because unbiased knowledge is pure. The purity of knowledge is an important construct. It removes STEM from the taint of humanity and, particularly, the taint of the individual.

However, STEM is not solely a body of knowledge; STEM is also a culture. People who are different, like me, have the same choices as anyone entering a new culture: either learn the language, assimilate, and participate or continue to speak your native tongue, stay on the periphery, and spectate. The challenge for someone breaking into this dynamic is that as individuals who are outside of the norms of this culture (women, people of color, and other under-represented groups) can feel compromised by pursuing their real interest in STEM. Beyond basic questions of concerning ability (Am I smart enough? Can I do this?)—which are common among students—other serious questions emerge about sense of place and belonging for those under-represented. Do they have to modify their value system to participate? Do they have to ignore or suppress their cultural background to fit in? Are their perspectives going to be valued? Do they have to suppress their opinions to minimize conflict? These cultural pressures are real and add an additional layer of complexity to already complex fields of study. Anyone who has participated in engineering or hard science education, for example, will tell you that mastering the material is a grueling process. Obtaining an undergraduate degree has been described to me as a “death march” or “getting hit by a fire hose on a daily basis.” Those comments were made by white males. Think about trying to master that level of material while simultaneously attempting to prove that you have a right to be present. It is not in any way surprising to me that under-represented groups leave STEM or even refuse to enter the field although capable.

However, leaving STEM is not the answer for under-represented groups. If we really want the STEM culture to shift, many of us are going to have to take one for the team. We need to be focused and directed, to search for mentors, to look for every opportunity and milk each one for all its worth—we should carve the path forward to real change. If we want a voice in what scientific questions get asked and answered and what technologies are developed, we should have a real seat at the STEM table as part of the STEM enterprise—as insiders.

Did I ever want to leave? Yes. More than once. The first time was when I was still an undergraduate. At one point in my junior year in 1975, I was going to leave engineering. I was tired of seeing the amazement on people's faces when I said I was a chemical engineering student. I recall telling someone I would expect a similar expression of astonishment if someone's dog started talking to them. I was tired of being told I didn't have a sense of humor when I would get smacked in the buttocks with a yardstick while I was trying to take measurements in lab or when I had a wet mark because someone hooked a lab water bottle in the back of my pants and squeezed. I was really tired of being asked by students and faculty alike whether I had found my husband yet—when was I going to leave anyway? Wouldn't I be better off on the other side of campus? I took a semester off to think about another

major. I thought long and hard. I was interested in engineering, but that wasn't the deciding factor. One thought kept recurring: "If you leave now, you will make it so much harder for the next female engineering student." I went back and finished. I subsequently went on to get another engineering degree and two science degrees. I have worked in private industry, consulting, and higher education. I have run science and engineering programs, did a stint as an assistant dean, and currently run a new multi-disciplinary science department at a university.

I would so like to be able to say that everything was so much better as I made my way in my career after I left school. But there were challenges in every decade. On my first engineering job when I was 23 years old, an entry-level male engineer who was hired at the same time I was stopped by my cubicle purportedly to say hello. On his way out, he turned and said, "Oh and it doesn't bother me if your starting salary is higher than mine, because you will never go anywhere in this company." Later in my career, an older male engineer confided to me that the fact that women could do engineering "ruined" engineering for him—it meant that you really didn't have to be smart to be an engineer and engineering must not be that challenging. In my mid-career (20 years in STEM), a male employee I *hired*—I was his boss!—told me that I needed to dress in a "more feminine way." I could go on, but what would be the point? I—and you—cannot let comments or attitudes like these change our direction: we are making the path so that others can follow. When I stayed for myself and those coming after, I found many good mentors of all sorts, men and women who helped me find my way. There are reasonable, talented people of good will who helped me move forward, and I am so grateful to have met them. You can find your mentors too.

Staying in STEM positioned me to be able encourage and mentor students of all types. I employ student projects that were never open to me during my own engineering education, like service learning, K-12 mentoring, Photovoice, and *PechaKucha*, to help students articulate their values and the meanings they ascribe to their learning. I value my students as the fantastic individuals they are. Is there room in my programs for someone different? The answer is yes. I have the authority to say yes for one reason: I made the decision to stay and to deal with the hardships and revel in the victories of participating in STEM.

As far as persistence in STEM goes, I have no statistical relevance. I am an N of 1. I am anecdote. I am also an individual who values herself, her lineage, and her point of view. Staying in STEM and making it my professional home has been challenging for me at points, and although I am an individual, I represent a multitude—not a monolithic one—but a wonderful kaleidoscope of individuals that I have had the honor of meeting, working with, and mentoring in my career. I revel in their successes as if they were my own. Forty-four years is a long time for an individual change but less so for a culture. Do you want to move the needle on STEM participation for your group? I have one word of advice: **stay**.

AUTHOR

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