

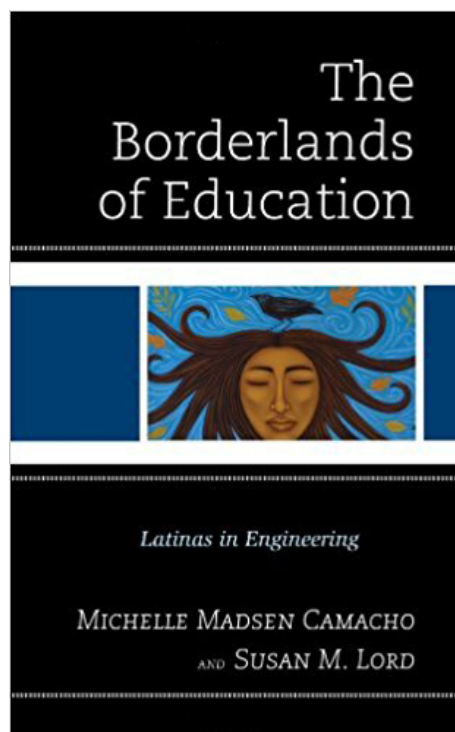
Camacho, Michelle Madsen, and Susan M. Lord
The Borderlands of Education: Latinas in Engineering
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Michelle Madsen Camacho and Susan M. Lord released *The Borderlands of Education: Latinas in Engineering* in 2013. The 2017 paperback release provides a catalyst for engineering educators, field professionals, and those who study engineering education to revisit structural and cultural patterns that are changing or holding back programs from the gender parity enjoyed in most other STEM fields.

The authors frame the text in critical race and Chicana feminist theory. Camacho and Lord's use of the term "borderlands" in the title is a nod to the work of Gloria Anzaldua's "Borderlands/La Frontera" (1987). In Anzaldua's semi-autobiographical work, she theorizes through essays and poems the concept of border identities and the complexities of living at the border. Identifying as a queer Chicana feminist, Anzaldua draws on the history of the U.S./Mexico border examining power and oppression across borders of gender, sexuality, and ethnicity. The physical and imagined borders produce a "mezcla" or hybridity of experience that locates an actor in a liminal space between worlds.

Camacho and Lord write that engineering is a borderland field. Engineering has been largely absent from primary and secondary education, as well as from the breadth of experience of non-engineering college students. Often isolated from other programs, engineering is not usually part of the college general education curriculum the way that math, biology, or even sociology might be. Furthermore, as an elite white male (straight) space, the presence of STEM-ready Latina



bodies is an exponential disruption. Latina engineering students live in the in-between world: as Latina engineers, they are aberrations both in the engineering world, as well as in the communities they call home.

As a white female engineer (Lord) and a Latina sociologist (Camacho), both authors experience the borderlands in their fields. Lord's account of the importance of a feminist studies class during her graduate education hints at the importance of feminist and critical race curriculum for all (women) engineers. She wrote, "The most difficult challenges for me in graduate school were not technical but social" (p. 15). The feminist studies class allowed her to situate her personal experience in a larger context of like experiences. Sociology educators know well the power of that moment when their own students make that connection between their personal

experience and society. This book offers the opportunity for many such moments for women (and men) engineering students in a field that remains often overwhelmingly white and male.

The book is accessible in its clear explanation of sociological concepts that focus our attention on important aspects of engineering education. It also provides a clear presentation of engineering demographic and graduation data, as well as an analysis of focus group interviews with women in engineering. I would recommend *Borderlands* as an excellent reference to the literature on diversity in engineering education. Furthermore, it provides its own engaging empirical contribution to that literature. *The Borderlands in Education* has broad potential for use in sociology of education classrooms, as well as science and technology studies (STS) classes. Yet perhaps most significantly, the book should be used by engineering faculty and their students, as they reflect on the culture and structure of their own departments.

Camacho and Lord, supported in part by a National Science Foundation (NSF) grant, weave together quantitative and qualitative data that generates a sense of the breadth and depth of Latina experiences in engineering education. Drawing on existing data, the authors insert the reader into the U.S. context where 2009 NSF data indicated that 18 percent of bachelor degree recipients were women and 2 percent of all recipients identified as Latinas (p. 2). A quick look at recent NSF data suggests a small nudge for some women in engineering: in 2014 almost 20 percent of the engineering degrees were awarded to women. Yet Latinas remained just 2 percent of all degree recipients (NSF 2014). Engineering and computer science remain the most recalcitrant of all the STEM fields when it comes to diversifying.

Another element of this monograph that I like is the interdisciplinary partnership of the authors. The text introduces without pretense the non-sociologist to central theoretical concepts linking them to a detailed understanding of engineering. These conceptual lenses focus our attention on

the organizational structures and cultural patterns that shape engineering education. In addition to the sociological imagination (linking biography and society), the reader is introduced to the social shaping of technology. This core STS concept highlights the influence of socio-political factors on the very shape and form of invention and knowledge (MacKenzie and Wajcman 1999). These theoretical insights bolster and explain the significance of diversifying the engineering profession: a diverse engineering workforce will provide diverse solutions to tomorrow's problems. Finally, the reader learns about microaggressions: These are the everyday seemingly innocuous messages (like surprise at one's presence) that collectively generate a tidal wave of adversity and stress for marginalized groups.

Given the steady rise in the U.S. Latinx population, the authors also build the case for targeted recruitment of Latinx to meet the growing need for engineers. Furthermore, they argue that this recruitment strategy will likely have desired outcomes: Latinx, once in engineering, persist at rates comparable to whites. Latinx in engineering graduate at higher rates (52-55 percent) than Latinx in other fields (47 percent) (p. 50).

Camacho and Lord note that given two-thirds of U.S. Latinx live in California, Florida, New York, and Texas, regional intensive recruitment makes sense (p. 44). California alone is home to the most Hispanics of all the states (Brown and Lopez 2013), as well as the fourth largest university: the California State University (CSU). Almost all the CSUs also have engineering programs (CSU 2017), so system intensity also makes sense. Almost all of the 23 CSU campuses are Hispanic Serving Institutions (HSI) as defined by the Higher Education Act (HEA). HSIs are colleges and universities where at least half the students are low income and at least 25 percent identify as Hispanic. "HSIs show the most growth in graduating Latino engineers" (p. 60).

For these reasons, the authors suggest “recruitment, not retention, is the challenge for Latino engineers” (p. 50). Still, students coming to engineering are already success stories: they have persisted through heavy math and science in high school. They have already moved through the “weeding out” process before they get to college: they are survivors. For that reason, almost ironically, engineering programs might offer the greatest potential for shifting the scale of student success and graduation even further. After all, 50 percent graduation rates are nothing to be complacent about -- even if they reflect better outcomes than those in other disciplines. The multi-pronged approach of both recruitment and structural changes in the engineering curriculum and pedagogy offer the greatest opportunity for large scale change.

The qualitative empirical data for the book is drawn from focus group interviews with 21 women engineering undergraduates who were persisting at a large public university at the time of the interviews. The book’s “case study” draws from the focus group with five Latinas. At some points the authors compare the experience of Latinas with other groups when distinctions or nuances are suggested. The authors were careful to point out the limits of their data. Nonetheless, the general themes they identified have been identified elsewhere. And their nuanced analysis of the narratives, along with the presentation of the data, provide grounds for engaging other women engineering students in similar conversations that will suggest pathways for change.

From stories about repeated surprise at their presence in engineering to blatant sexist jokes, the Latinas’ interview data constructs a narrative on ongoing adversity. Those microaggressions are also experienced at the institutional level as Latinas encounter classroom and extracurricular structures that pit them against each other. Whether it is competition for a finite number of internships and research assistantships, or an exam end-game that requires score distributions that produce failing grades, one begins to

understand the “chilly climate” that students report in engineering.

In the last chapter, “Crossing Borders,” the authors provide a roadmap for changing engineering education. This roadmap reaches deep into the educational system, discussing K-12 education, as well as the significance of work with community colleges -- the launching point for many Latinx in engineering. As is often the case with inclusive strategies, these changes would likely have a positive impact on all students across gender, ethnicity, and social class. Furthermore, Camacho and Lord map successful efforts of educators and administrators in changing the structural landscape of their field. As they aptly note, creating university level engineering courses that will attract students across disciplines is a challenge that will require faculty to step “outside their comfort zones” (p. 95). They also detail the need for faculty training and a shift toward pedagogies that value and integrate experience-based learning that contributes back to communities. The days where abstract problem solving was the reward itself must be left behind.

The problem-solving, positive ending to the book aligns with the work of Anzaldúa. She became increasingly hopeful about the insights provided by those with border identities. In her co-edited volume with Analouise Keating, “The Bridge We Call Home” (2002), Andalzua theorized border identities as a source of strength, connection, and a pathway for a revolution. This theoretical insight into Latinas in engineering then highlights not only their struggle, but also the potential for Latina border identities to change engineering education and practice.

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work at the 2015 *Frontiers in Education (FIE)* engineering conference in Madrid, Spain. Professor Virnoche also collaborated with computer science, engineering and math faculty members on a National Science Foundation S-STEM grant. Her current work focuses on major-based peer mentoring as a means to support the success of first-generation and underrepresented groups in higher education.

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