Institutional Influences that Promote Studying Down in Engineering Diversity Research

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Despite a thirty-year history of initiatives and interventions to recruit and retain women and other minority engineering students, women remain a minority in engineering, and enrollments of female engineering students have declined from gains made in the 1980s and 1990s. In the United States, enrollments of female students seem to peak and plateau at around 20 percent, with many institutions having a much lower percentage than that. Enrollments of people of color are on average even lower. Significant time, energy, and money has been spent trying to increase diversity (read: numbers of minority students) but has not led to the desired gains in enrollments of female and other minority students.

In the spring of 2013 the following text appeared in a job announcement for a newly created position called director of diversity research, located within a college of engineering at a large public research university in the midwestern region of the United States:

Principal duties: The College of Engineering recognizes that in order to ensure successful outcomes, diversity programs require leadership that has the experience, training and expertise to apply the appropriate theory and research framework to program development, implementation, administration, and evaluation. This approach allows the College of Engineering to identify theoretically sound, evidence-based strategies to support student success. A programming approach that is grounded in a research framework can provide the evidence and rationale that allows for institutional transformation that supports and sustains diversity. The Diversity Director . . . will conduct research and contribute to the research-based knowledge about the interventions and practices that lead to diversifying the engineering profession and will be responsible for managing, designing, leading and implementing research-
based practices that support and maintain diversity in the College of Engineering.

Degree and area of specialization: Doctorate required; preferably in a discipline that provides quantitative, qualitative and organizational systems training, such as sociology, industrial engineering or other social science degree.

This was a newly created position with the stated aim of developing evidence-based programs and conducting research to increase diversity within their college of engineering. It should be emphasized that this engineering college already has a Diversity Affairs Office that runs outreach and minority student programs. This was a new position that was ostensibly dedicated to original diversity research.

As part of the interview, the search committee asked candidates to develop a ten-minute presentation outlining their research goals for the position. I was a candidate, and my proposed research agenda centered on studying faculty and all students, as opposed to problematizing women and other minority students. I proposed that it was important to understand faculty beliefs and practices surrounding diversity and to target interventions to the entire student body rather than solely to fixing perceived deficiencies in minority students. I explained that these were important and severely neglected research topics because despite key studies revealing the significance of faculty and classroom interactions to minority students, the vast majority of research continues to focus narrowly on those students themselves. I also explained that I had a successful publication record built around conducting research of exactly the sort I was proposing to continue in the new position.

It quickly became clear, however, that the position was in actuality for traditional program development and evaluation targeting minority students only. The search committee’s questions centered solely around my experience with program development and implementation, K–12 outreach, and undergraduate students. It is possible they asked about these topics because they felt they already understood my research goals and agenda, but the questions indicated to me that they were not interested in advancing the research landscape or addressing the limitations of the status quo in engineering diversity research. There was no vision for how and why the research landscape needs to change. This conclusion was reinforced when they explained that the first task the person in the position would be doing would be to analyze data they had collected over many years from the summer programs they run for K–12 students. The data consisted of questionnaires covering items such as interest in engineering and intent to pursue engineering in college, as well as math test
scores. Thus what they wanted typifies the dominant mode of inquiry in engineering diversity research. The aim of this paper is to give that mode a name, to highlight its unquestioned status, and to identify institutional factors that promote it.

My educational background is in critical social science fields. When I first began working in engineering education, I was working on a project that entailed reviewing a large number of engineering education publications. A significant subset of those publications was concerned to varying degrees with the underrepresentation of women and, to a lesser extent, people of color, in engineering. The lack of engagement with feminist or other critical theories and methodologies in those articles struck me as a significant limitation. It was a problem, I believed, because the kinds of research being produced were the same kind that had been produced for the past thirty years but had not actually managed to increase significantly women’s participation in engineering or to increase “diversity” as diversity is operationalized as numbers of students from various demographic groups. Of course, “diversity” should be understood as broader than demographic-based body counts, but that is not yet the case for many in engineering education. As I and others have argued, part of the reason underrepresentation persists is because the interventions undertaken and the research based on them have largely ignored social and institutional structures, opting instead to focus on “fixing” students from underrepresented groups. Of course, there are important exceptions to that generalization, but they are just that, exceptions. (In this essay I use the terms minority and underrepresented to refer to both women and racial/ethnic minority groups.)

I saw an opportunity to introduce feminist theories and methodologies to an engineering education audience, and I wrote several articles with that aim in mind. While I was not under any naïve modernist notions that simply giving people knowledge would necessarily change their beliefs or practices, I did underestimate the extent to which institutional rather than epistemological barriers prevented greater engagement with critical theories and methodologies. Since writing those articles, I have become increasingly aware of the institutional barriers and the ways in which they are intertwined with epistemological barriers. My recent interview for the director of diversity research position drove the point home quite strongly. It is not simply the case that diversity scholars in engineering education are unaware of critiques of the research status quo (although many are unaware); rather, there are real institutional influences that have shaped the research landscape, influencing the types of research that have been dominant. Studying down is but one example
of the lack of engagement with feminist and other critical theories and methodologies that is perpetuated by institutional influences.

*Studying down* refers to the trend in social science to study and locate problems within groups and individuals in positions of lower social status and power. The critique made by feminist and other critical scholars is that this tendency has left those in positions of higher social status and power unchallenged, unproblematized, as the norm. The point is not that it is unimportant to study those in positions of less status and power, but rather that studying down has dominated the social research landscape, leaving a significant gap in knowledge about those in power and promoting social inequalities through methodologies that implicitly normalize those with greater capital (social, economic, political, etc.). Studying down characterizes the subjects of research and the assumptions shaping the research approach; it does not characterize the gender of the researcher. In other words, female as well as male researchers can study down, even though in many contexts women and people of color are in positions of lower social status and power than white men.

Alternatives to studying down have been termed *studying up* and *studying sideways*. To study up is to have as a subject of inquiry those with greater social, economic, academic, or political capital, or powerful institutions more broadly. To study sideways is to examine those who are in social locations similar and more parallel to that of the researcher. These corrective alternatives to studying down are valuable and lead to less biased science because they broaden the range of social phenomena that are explored, open up institutional practices for questioning, and reveal problems with normalized practices of the status quo. It should also be noted that not all studying down carries the same level of deficit model assumptions. For example, there is a difference between studying down that examines students’ experiences in order to learn about problems with faculty and studying down that starts from a belief in minority students’ lack of self-efficacy and proceeds to implement a program to improve it. Therefore, determining instances of studying up or down is not simply a question of research subjects but rather about the aim, approach, and assumptions of the research as well.

Studying down has been the dominant mode of inquiry in engineering education diversity research. In that context, it means that minority students are the subject of inquiry and target of reform. More specifically, it is underrepresented students’ self-efficacy, mathematical and spatial abilities, communication skills, and cultural capital that are often studied and addressed. Exceptions can be found, but the vast majority of research leaves faculty, administrators, and majority (white, male, middle-class) students unquestioned and unprob-
lematized. My aim here is to call attention to the problems inherent in that mode of inquiry by naming it (studying down) and identifying factors that work against large-scale changes to the research landscape. Although this essay focuses on education contexts, similar arguments could be made about tendencies to study down in engineering workplaces in industry settings.

INSTITUTIONAL INFLUENCES

Taking the entire body of engineering education conference papers and journal articles, almost all the research on women and people of color in engineering is conducted by faculty and staff who are institutionally located within engineering departments. While recent trends in outlets such as the *Journal of Engineering Education* suggest that scholars from social science departments are increasingly being enrolled in that research and collaborating with engineers, the work they are publishing in engineering education outlets is not significantly different from the work done solely by engineers. The barriers identified later in the present article are each related to the institutional positioning of the majority of scholars in engineering departments. The fact that this scholarship comes out of engineering departments is not something widely commented on by researchers, perhaps because it seems so obvious that it is taken for granted as inconsequential. Engineering departments ostensibly have the biggest stake in improving diversity and increasing the numbers of qualified students they enroll. Yet, as I discuss the following barriers, it is worth reflecting on how different the research landscape could be if scholars or centers were located primarily in Women’s Studies, African American studies, or Science and Technology Studies (sts) departments, for example. Of course, whether such research could be published in engineering education journals is another matter altogether, and publishing necessities represent another set of challenges, which I have discussed in greater detail elsewhere. Publishing in women’s studies journals, for example, is less likely to affect the engineering education community. Here I focus on very basic matters of the research process more narrowly.

1. *The Programming Influence*

Much of the diversity literature is based upon programming initiatives; that is, programs targeted at recruitment and retention of minority and K–12 students. Often these programs are developed by faculty and staff from special Women in Engineering or Minorities in Engineering centers or Diversity Affairs offices located within engineering departments. At other times they are
developed and led by engineering faculty not under the umbrella of a designated center or office but still within engineering. Common topics for these programs include increasing awareness of engineering among K–12 students; design competitions specifically for women; mentoring of minority students; and increasing the math and science skills of minority students. A typical conference paper based on such programs explains why that program is needed (typically just citing underrepresentation statistics), describes the program in detail, and presents findings on what students gained from the program. Sometimes the findings reveal no more information other than students saying they liked the program. Often they consist of pre and post questionnaires on issues such as interest in and knowledge of engineering. By and large it is a body of literature built on studying down, on locating solutions to underrepresentation in fixing the perceived knowledge and skill deficiencies of minority students.

Given the effort, time, and money put into student programs, it is no doubt important to evaluate those programs. And given that those types of programs continue to receive funding, it no doubt makes sense to keep running more of them. Of course, the problem is not with programming per se, but rather with the type of programming that is dominant. One could imagine a very different type of programming, one with interventions targeted at faculty, administrators, and majority students, but there are numerous reasons why that type of programming is unlikely to become widespread anytime soon. Of the various groups that could be targeted for programming and interventions, minority students and K–12 students are the easiest (in numerous ways), safest, and most feasible to target and access.

I am not the first to have made the connection between programming and the resulting body of literature: several years ago I interviewed feminist engineering education scholars about their experiences undertaking self-labeled feminist projects within an engineering education context. When asked about barriers to increasing such initiatives and research, one participant said:

I imagine at a lot of other institutions people who are doing research on gender might be incorporated to some degree in institutional efforts to recruit and retain women in engineering. And so their research might dovetail in some way . . . with those efforts. . . . Maybe it's that the needs of the institution to deal with the representation issue might create structures for shaping people's research that might not be the best question to ask or the most interesting question to ask because you have to be focused on the programmatic questions.8
While this interviewee was speaking about challenges to feminist research more broadly, the comment certainly applies to studying up specifically.

2. The Identity Influence

As noted, almost all the scholars producing engineering diversity literature are located in engineering departments. This means they have largely been trained as engineers, a reality that carries several implications. First, most have not been exposed to critical social science, such as critical race theory or feminist methodologies. Second, their academic training implies then that part of their identity is likely bound up with engineering. On one hand, identification with and intimate knowledge of engineering culture could result in a greater propensity to critique that culture. On the other hand, identification with engineering can make critiques of the field threatening and result in lack of willingness to move beyond the student deficit model to examine systemic and institutional problems with engineering. The researchers are part of the very system they would need to critique in order to study up. While these are certainly epistemological and identity barriers, they also need to be understood as institutional barriers: the epistemological and identity issues are only barriers because the majority of diversity research is done by engineers. In other words, if the majority of research was done in women's studies departments, then engineers’ training and identities would not be barriers to studying up. That intertwining of types of barriers has not been fully appreciated. Most commentators have focused on the epistemological challenges that come with trying to move engineering education research into new arenas.

3. The Political Influence

Finally, departmental and institutional politics no doubt play a role in hindering any significant amount of studying up. As with the other barriers, this barrier stems from the fact that those doing the research are institutionally located within engineering departments. It is not difficult to imagine the challenges and risks one would face when attempting to study fellow faculty members critically in one's own department, not to mention department chairs. For instance, untenured faculty members could risk angering colleagues from whom they need support, especially in tenure and promotion voting. Even tenured faculty would likely hesitate to undertake research that might uncover deficiencies or poor practices of the very people they have to work with day in and day out. Staff members who work in Women in Engineering and Minorities in Engineering programs or centers are likely in an even more precarious
situation, with year-to-year contracts and significantly less clout than tenured and tenure-track faculty. It is easy to understand why focusing on students instead of faculty and administrators is appealingly easy and safe. Students are easier to access and safer to study and to problematize. For example, a study that explores why female students chose engineering (which is a ubiquitous part of the research landscape) carries little to no risk of offending colleagues. On the other hand, a study that explores how your department chair contributes to underrepresentation through personal assumptions about minority students carries significant risk. Furthermore, the traditional, student deficit model programs and types of research continue to receive funding, meaning that there is little external motivation to change, to take those risks. Of course, engineering faculty could attempt to study faculty and administrators at other institutions, but even then access could be a barrier: there may be obstacles related to obtaining consent to be studied from engineering faculty members and administrators.

Scholars in women's studies, various ethnic studies departments, sociology, and STS departments, however, do not face the same career risks from studying up vis-à-vis engineering (although as noted, if they want to publish in engineering education outlets they are constrained by publishing norms, and they may face access barriers as well). They would not be critiquing fellow faculty who could prevent their tenure or administrators who could decide not to renew their contracts. However, scholars in those other departments have their own research interests, which by and large do not include diversity in engineering. The limited amount of interest, combined with a perceived lack of a stake in the issue, means that no significant amount of engineering diversity research is likely to develop organically in departments outside engineering. Additionally, even if more research was done by scholars in these fields, there would likely be issues of legitimacy that would prevent engineering audiences from accepting or acting upon that research.

In contrast to women's studies, a field built on a tradition of social critique and reflexivity, the same kinds of social critique and reflective practices are much less common in engineering. I would argue that cultural differences between the fields make studying up both less common in engineering and less well received when it does occur. While women's studies scholars have critiqued institutional practices carried out in their own departments, the fact that the field is built on social critique tends to make that type of work more valued (although even in women's studies, critiquing the practices of women's studies departments is not one of the more common topics of research). I am not suggesting that engineering education researchers cannot study up; rather, I am exploring reasons why they tend not to. Perhaps examining the ways in
which scholars in other fields have successfully studied up would be instructive for engineering education researchers.

WHAT POSSIBILITIES FOR CHANGE

The alternatives to studying down in the context of engineering education would require having faculty, administrators, and majority students as the subjects of research and interventions. However, the institutional barriers identified here work against that type of research, which problematizes faculty, administrators, and dominant groups. The institutional barriers to studying up or sideways mean that simply bringing greater awareness of the limitations of studying down will not work. These observations also reflect challenges that apply to engagement with feminist and critical theories and methodologies more broadly. As noted, studying down is but one example of ways in which the engineering diversity landscape is hindered by that lack of engagement.

I have argued that the institutional influences stem in different ways from the fact that most research is located within engineering departments/colleges. It would seem that one logical solution, then, would be to conduct diversity research from an institutional location outside engineering. However, this does not seem at all feasible or likely actually to happen. First, it is not likely because the problems with the current research are not widely recognized or discussed by those within the community. Critiques generally come from outside. Second, it is not likely because researchers in other institutional locations do not have the same level of interest or incentive to conduct engineering diversity research as those in engineering. What other solutions exist then? This is a question I continue to explore.

Interdisciplinary research by teams of engineers and social science or humanities scholars may present promising possibilities. Such collaboration is one way to overcome credibility issues that non-engineering scholars may encounter if they do not collaborate with engineering colleagues. It is also a way for non-engineers to gain access to insider knowledge about engineering they may not otherwise have. The benefits of interdisciplinary collaboration across engineering and social sciences have been discussed by others.

However, research also shows that the work being published in engineering education journals by interdisciplinary teams is not significantly different from that done by engineering-only teams. This raises questions about the extent to which the need to publish in engineering journals limits the innovative potential of interdisciplinary teams. And if the work is published in non-engineering journals, then issues of access and credibility again become
salient. Therefore questions remain about how the full potential of interdisciplinary research groups to influence engineering education can be realized.

It is also the case that efforts targeting faculty may exist but are not being documented in archival publications. For instance, in teaching enrichment or faculty development centers, faculty may learn about gendered facets of engineering education practices, but confidentiality concerns may make studying these efforts through formal research difficult. Additionally, those doing that work may not be in positions where publication is expected or rewarded, making motivation to do so scarce. In that case, it seems that those efforts are not likely to have an impact on the research landscape without changes to the reward structure of those positions and creative efforts to overcome confidentiality concerns.

The creation of more diversity positions, such as the one discussed at the beginning of this article, also has the potential to be one such solution. Such positions would present an opportunity to hire people from critical social science backgrounds, people who do not have obligations to student programs, engineering training or identities, or the same level of political constraints as other faculty members in the department. (Granted, they no doubt still have to worry about job security.) However, the potential those positions hold would only be realized if they were not squandered on promoting the status quo by continuing to focus on student deficit model program development and evaluation. It is my hope that this article serves as an intervention into the research status quo by raising questions about studying down and identifying the institutional challenges that will need to be overcome for widespread change.

POSTSCRIPT

This essay was written in 2013 and accepted for publication in 2014. Since the time of writing, I have been awarded a National Science Foundation grant from the Engineering Directorate entitled “Characterizing Faculty Discourses on Gender in Engineering Education for Effective Interventions” (NSF EEC #1427553). I hope it will serve as a model of studying up that will prompt other researchers to consider studying up as well.
the Global Engineering Series at Morgan and Claypool Publishers. Her current research interests include gender in engineering education research, interdisciplinarity, peer review, engineers’ epistemologies, and global engineering education.

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