
AC 2011-1548: METRICS OF MARGINALITY: HOW STUDIES OF MINORITY SELF-EFFICACY HIDE STRUCTURAL INEQUITIES

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Metrics of Marginality: How Studies of Minority Self-Efficacy Hide Structural Inequities

Abstract

In ongoing attempts to correct minority underrepresentation in the engineering disciplines, educational researchers, cognitive psychologists, and scholars in related fields have since the 1980s developed many studies centered on the notion of student self-efficacy.¹⁻⁶ These studies seek to measure the degree to which under-represented minority or otherwise marginalized students experience a sense of self-confidence or feeling that they are able to counter "barrier conditions." Those conditions might include discrimination or other challenging social and intellectual situations encountered in college. While such studies are certainly preferable to a denial of differences between minority and majority experiences, they intentionally or otherwise support the notion that it is marginalized persons, not institutions and majority conduct, that require change. These studies commonly center on detecting which classroom or social behaviors on the parts of individual students seem to accompany significant self-efficacy. Socio-cultural conditions (such as endemic racism, sexism or ageism), and the institutional practices that embody those inequities (such as majority-focused pedagogical theory, or biased treatment of minority students by instructors and administrators) may remain invisible to the researchers and those who deploy their findings. What is more, older assimilationist ideologies, like those expressed in educational interventions of the 1960s and 1970s that sought to suppress minority students' ethnic self-awareness and sense of racial or gender collectivity, find new life through such confluences. This paper considers the potential of self-efficacy as a reformist tool in minority engineering education, and the risks of its uncritical application

Introduction

African-American participation in STEM fields has been an object of systematic study by educators and policy makers since shortly after World War II. "Workplace diversity" entered the lexicon of business management following the dramatic civil rights reforms of the 1960s and continues to exert its influence on corporate recruitment and hiring. Yet, the representation of black Americans in STEM degree programs and occupations remains disproportionately low despite legal protections and minority set-asides through the years. In part, this persistent inequity is due to shrinking federal education budgets and anti-affirmative action efforts that have eroded black enrollment in higher education more generally over the last two decades. There is no question that many faculty and administrators around the country are seeking to correct this pattern; programs geared toward enhanced minority recruiting, mentoring, tutoring and financial support abound. But, as a recent overview of these activities has found, these efforts have "not led to systematic change in perception and retention in engineering."⁷

This paper centers on a single formulation which has played a role in educators' studies of minority STEM experiences since the 1980s: The notion of student self-efficacy.¹⁻⁶ Using this concept, researchers seek to measure the degree to which members of under-represented

minority groups or otherwise marginalized students experience a sense of self-confidence or feeling that they are able to counter "barrier conditions." Those conditions might include discrimination or other challenging social and intellectual situations encountered in college. In some invocations, a focus on self-efficacy has been used by researchers to assess minority acceptance into educational institutions or otherwise draw our attention to discriminatory conditions. But a far greater number redirect our attention to the behaviors and psychological states of individual minority students, obscuring the social context in which entry and success in engineering fields play out. These are "person-centered" rather than "situation-centered" depictions, to use the terms coined by reform-minded community psychologists.⁸

Studies focused on measuring self-efficacy among STEM students commonly center on detecting which classroom or social behaviors on the parts of individual students seem to accompany significant self-efficacy. Socio-cultural conditions (such as endemic racism, sexism or ageism), and the institutional practices that embody those inequities (such as majority-focused pedagogical theory, or biased treatment of minority students by instructors and administrators) are of more or less limited consequence to many of these researchers and those who deploy their findings. What is more, community psychologists have shown that person-centered inquiries focused on individuals' self-efficacy routinely conflate subjects' *sense* of self-empowerment and the attainment of real social power or influence.⁹ Studies of this kind thus falsely conclude that where self-efficacy is detected, the problem of minority marginality has been solved. This paper briefly describes alternative invocations of self-efficacy that highlight the origins of student experience in larger social structures, to explore the potential of self-efficacy as a reformist tool in minority engineering education, and the risks of its uncritical application.

Ascriptions of Agency

At the heart of educators' use of self-efficacy as an "effective predictor of individuals' performance outcomes" is work by Bandura from the 1970s onward.¹⁻² As one scholar summarized this work, it is predicated on the idea that, "Individuals with high efficacious beliefs think, feel and act in such ways that they actually create their own future rather than simply foretelling it."⁴ Seen in this way, self-efficacy logically becomes a factor in student retention, helping individuals to contend with immediate discouragements by focusing on a point remote in time and the rewards of persistence in the short and long terms. Among those who study student retention in engineering, "one's confidence in his or her ability to reach academic milestones" is customarily seen to predict desire to become an engineer.^{4, 10}

Individual agency is cast in such formulations as something which not only exists in meaningful form among all students, of all backgrounds, but which, when present in sufficient amounts, can determine a student's interior life (promoting the desirable activities of "self-regulation" or "self-reflection") and also his or her outwardly visible activities such as the attainment of good grades, or persistence. Skill acquisition and confidence are mutually supportive in many of these analyses, with both attainments in turn leading to success in college and the workplace.¹¹ Negative interior experiences, such as anxiety and fear, also configure some students' performance and are seen to impede life success. While psychological sciences have clearly pointed to the powerful role that our inner lives and sense of agency may play in our social experiences, the difficulty with using such heuristics to explain minority under-representation in

STEM is that institutional conditions are side-lined. The existence of discriminatory cultural norms, such as racism, and institutional conditions that embody those norms may either be left out of explanatory models all together or treated as conditions with which individuals should contend. Psychologists concerned with liberatory projects have explained how the human sciences have discouraged social change through their focus on the individual^{12, 13}, a pattern which historians of race and gender in the life sciences have confirmed.¹⁴

In engineering education fields, there are at least two ways in which this diminution of social structural conditions can be countered in studies of minority student self-efficacy, both embodied in the work of scholars who begin from the premise that a "potentially inimical environment" discourages minority retention. Some work of this kind explains that to bring about authentic reforms, any study of minority experience must also include attention to "the attitudes of the group which dominates STEM fields, namely white males" This approach helpfully casts engineering as a culture, "with gatekeepers and its own particular code."¹⁵ The work of historians, sociologists, and race theorists who have problematized majority attitudes and behaviors, often in direct investigation of such experiences as "whiteness" or "masculinity", contribute in important ways to this kind of investigation.^{16, 17, 18}

A second body of scholarship on equity in engineering education problematizes the idea of agency itself. Jaffee and Riley propose that no student begins life with a set allocation of energy, desire, or inner strength but rather that life experiences powerfully determine such attributes. Motivation cannot be disaggregated from cultural and family influences.¹⁹ Even a cursory look at public education across American communities shows that the likelihood that an individual will experience effective mentorship and social support tracks directly onto gender, ethnic, race, and class differences. With this contingency in mind, the measurement of self-efficacy can be tied to a much larger social project. Most suggestively, Jaffee and Riley draw our attention to the fact that it is in leaving engineering that some women express agency. We certainly need not accept as final or desirable the departure of these young women from STEM fields, but if we are to understand the complex relationship between identity, self-efficacy, and equitable opportunities in STEM disciplines, such broadened definitions of what counts as self-confidence and self-determination will be vital. McLoughlin's work on so-called non-traditional students (a problematic word in itself) in engineering-related disciplines, among the few social scientific considerations of two-year colleges as sites of identity formation, supports this approach as well.²⁰

Validating the System

Jaffee and Riley, McLoughlin, and other scholars focused on matters of identity, rather than on individual characteristics, effectively break with the implicit validation of conventional metrics of STEM success on which many other researchers in the field rely. Those metrics allow existing standards for college admissions, curriculum length and pace, curriculum design (with remedial support heavily stigmatized) to stand unchallenged, despite the origins of such standards in discriminatory ideologies.²¹ This is not to say that scholars focusing uncritically on self-efficacy in STEM are themselves biased; the opposite is often demonstrably true. But some of this work does contribute to the "black boxing" of engineering and engineering education as activities that neither derive from larger social relations nor perpetuate those relations. In such

renderings, engineering knowledge stands apart from the conditions of its formulation and dissemination in ways that are not entirely consistent with findings of the history and sociology of engineering and policy studies of educational equity.

For example, Huang writes:

Students who are positive about their academic skills (high self-efficacy) expect high grades on exams and expect the quality of their work to accumulate benefits. The opposite is true for students who lack confidence.¹¹

In this formulation, high self-efficacy appears to be a reliable motivator of learning, as it may well be, narrowly conceived. But this association also may discourage us from seeing that students who are positive about their academic skills may *start out* from a different social position (that is, one which permits and/or encourages self-confidence) than those who remain unsure of themselves. In constructing his study of engineering student self-efficacy, in which variables also included college and high school GPAs, Math SAT scores, and vocational interests, Huang might have problematized how all of those attainments also derive from socioeconomic background, extending the lessons to be drawn from his research. Direct causal links between social context and student "performance" were a much more common subject of research during the 1960s and 1970s. Those older context-focused studies and a few contemporary examples of this approach provide a good resource for scholars concerned with racial, gender and economic equity in higher education.^{22, 23}

What is more, Marra's study of self-efficacy among women engineering students suggests that once differentials in the self-efficacy of different groups are detected, and deemed worrisome by administrators, "a supportive, effective curriculum" might be developed in order increase the "feelings of inclusion among students of different races."²⁴ In turn, Lindley suggests that self-efficacy studies could be used precisely as an instrument to detect students' self-defeating beliefs about their own capacities, to "offset negative expectations or stereotypes" but in the process also to reveal discriminatory structures.²⁵ But in order for studies of self-efficacy, or of any other individual student characteristic, to lead to such structural reform of sociopolitical conditions, analysts must head into such studies with a sense that social structures are in need of change, as do Marra and Lindley. Instead, studies of engineering education which deploy self-efficacy as a concept often deemphasize "person-environment interactions" but subsuming them within, rather than without, individual experiences; couching their analysis, for example, in the guarded formulation that student experiences of racial discrimination "may or may not be true."⁴

Why are such contextual matters not more frequently or thoroughly incorporated into studies of minority STEM participation? This is a complex issue that has do to with the history of racial ideology in the United States. Not least important in understanding this history is a growing sentiment over the last decade that we need no longer consider race to be nearly as determinative of privilege or political power as it once was. We are said to be in a "post-racial" era by many who feel confident that, say, affirmative action policies brought sufficient reforms in the 1980s and 1990s, or that the election of an African American president confirms the establishment of an "even playing field" for all ethnic groups in the nation. But such wholesale rejections of race based discrimination are only part of the problem. Other issues arise precisely because

corporations and policy bodies still endeavor to bring more diversity to their staffs, and because of the manner in which they do so. These diversity efforts assert the importance of enhanced minority presence in STEM fields, in turn encouraging educational inclusion. But at the same time, these initiatives deflect attention from social-structural inequities that may be standing in the way of equitable opportunities in these fields.

In part, corporate diversity programming today grows out of the belief that globalizing markets demand enhanced "cultural competence," perceived to be an ability to communicate effectively with clientele and employees from other nations.²⁶ But corporate and government concern with the "competitive" stature of U.S. industry on the world stage is perhaps a more pervasive driver of inclusion efforts in STEM; the rapid growth of industrial economies in China and India pose particularly daunting obstacles to the future hegemony of American scientific and technical enterprises. As diversity consultant Doug Freeman puts it:

We look at the progress of corporate diversity over the years as a natural evolution...Diversity 1.0 was about compliance and abiding by government regulations. Diversity 2.0 revolved around ethics, morality and social responsibility. Today, Diversity 3.0 is about business integration and globalization...and, ultimately, producing increased employee productivity and new revenue streams.²⁷

Whether competitive anxiety is the basis of diversity reform efforts, or invoked by diversity advocates because they believe it to be so for corporate leaders and economic policy makers, it is nonetheless a priority which subordinates inclusion to performance and productivity. Sufficient industrial productivity, or profits, are of course culturally determined and have not historically led to the redistribution of economic opportunity. We could consider then, how likely inclusive reforms are to arise from logic grounded in the enhancement of corporate economic security, compared to those that might have been motivated by "ethics, morality and social responsibility." But more immediately, we might also see that diversity programs intended to increase America's corporate or national productivity are compatible with the use of self-efficacy as a simple predictive instrument in STEM education, in that such uses stress the individual attainment of efficacy rather than examine opportunity structures that may provide access to learning and training opportunities.

The Corporate Model

This diminution of social structural forces is demonstrated by Farr and Brazil, in which we are told that leadership qualities among engineers derive from one's "genetics, childhood upbringing, and adult experiences."²⁶ In many ways their article seeks to encourage broader workplace opportunities, by introducing ways in which managers might support the development of employees into "leaders." But their framing of the matter may limit these positive impacts. First, the invocation of genetics is itself problematic; many genetic and cognitive researchers doubt whether intelligence can ever be associated in a meaningful way with biological endowments.¹⁴ We might ask how the notion of inborn traits is functioning in analyses, like Farr and Brazil's, that uncritically deploy such terms today. Perhaps, given the immutable and essentialist implications of genetic endowments, its invocation offsets for readers the importance of acting on situational matters such as upbringing and life experience.

While social context is not entirely absent from this model, the authors' suggestions for how leadership may be cultivated in young engineers returns repeatedly to the importance of individual "capacity." For example, through "self-assessment" and decisions about what one would like as an "ideal self," individuals may "identify gaps they would like to address," perhaps through "attempting new behaviors." This formulation seems compatible with invocations of self-efficacy that downplay the social conditions in which "capacity" forms for students and employees (or does not).

In a sense, the very structure of the corporation as a self-interested unit, prioritizing its own interests over those of any wider community, may undermine well intentioned reforms. One may see those two sets of interests as compatible with one another to a greater or lesser degree, but they are unquestionably distinct. In America, responsibilities for social change do not necessarily reside in private businesses. For example, in Farr and Brazil's account, it is presumed that "mentoring" will overcome the effects of gender discrimination.

In leadership development, mentorship is especially important for young female engineers. Often, in the politically correct corporate world, open conversations about the challenges of being female in a male dominated profession are avoided. Mid-level managers must take care to include women in their coaching and mentoring.²⁶

This concern with gender exclusion is welcome, but no suggestion is made for how women and other minority groups currently under-represented in engineering occupations will *gain entrance* into the corporate settings so that they may be mentored. The term "politically correct" also implies that some gender concerns already manifest in the corporation are regrettable, in the authors' view. The address of gender discrimination with so brief an analysis may lead readers to a reductive understanding of these issues. Similarly, globalization is worrisome to the authors, but nowhere discussed as endemic to market-based corporate culture, in which economic rationality demands that companies hire the lowest wage workers; that market logic is not easily contravened by "inclusive" ideology, however heartfelt.

In several ways, then, Farr and Brazil's approach, while clearly seeking to empower individuals who may not currently receive supportive treatment in engineering classrooms or workplaces, leaves out some pieces of the STEM inclusion puzzle. Inclusion, in their discussion, centers on actions taken by individuals, in the interests of other individuals, in engineering workplaces. If the conditions on which their analysis proceeds reflect those in which engineers from under-represented groups are likely to find employment, then the use of self-efficacy as an instrument for measuring individual capacity and merit (rather than as a means of assessing collective social progress or its absence), may make perfect sense. We can ask, however, if these conditions are desirable in a society that seeks equitable and democratic opportunity structures, in STEM and all other fields.

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