The Double Bind: The Next Generation

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In this foreword, Shirley Malcom and Lindsey Malcom speak to the history and current status of women of color in science, technology, engineering, and mathematics (STEM) fields. As the author of the seminal report The Double Bind: The Price of Being a Minority Woman in Science, *Shirley Malcom is uniquely poised to give us an insightful perspective on the development of this field over the last thirty-five years. She has spent the intervening years working on increasing diversity and inclusion in STEM education and careers. Her daughter, Lindsey Malcom, represents the next generation of scholars seeking to understand and advance the representation of women of color in STEM. Together, they connect the past and the present regarding the pathways used by minority women entering STEM, their patterns of advancement, and shifting paradigms on how best to support women of color in these fields.*

This year marks the thirty-fifth anniversary of the publication of *The Double Bind: The Price of Being a Minority Woman in Science* (Malcom, Hall, & Brown, 1976). This report, a product of the 1975 conference, was the first occasion to call out the special challenges faced by underrepresented minority women who pursue education and careers in science, engineering, mathematics, and biomedicine (i.e., STEM fields).

In the intervening years since its publication, much has changed, and much has not changed. STEM fields continue to be overwhelmingly dominated by Whites and men, although the passage of laws banning discrimination on the basis of race and/or sex reduced the number of overt practices that shaped the university and workforce cohorts of previous years. For example, passage of Title IX in 1972 effectively removed the system of quotas limiting the number of women admitted to medical schools in the United States. And in the intervening thirty-five years, women went from representing around 16 per-

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cent of medical school graduates to nearly half (AAMC, 2010; Malcom et al., 1976; NSF, 2009). These overt systems, though occasionally still appearing, for the most part have been replaced by more subtle barriers for women, which still reduce access and opportunity for education, careers, and advancement in science-based fields.

The next-generation women, the Double Bind Daughters, face different challenges from those faced by their mothers. Now it is less about rights versus wrongs and more about support versus neglect; less about the behavior of individuals and a culture that was accepting of bias as the "natural order of things" and more about the responsibilities and action (or inaction) of institutions.

For minority women, sex-based barriers are only half the story, however; the attendees at the 1975 conference suggested that barriers based on race/ethnicity were more significant early on in their education, for example, in lack of access to quality K–12 education, rigorous course work, and high expectations. Unfortunately, these remain high hurdles within U.S. society for African Americans, American Indians, and Latinas/os, so-called underrepresented minorities (URM), where institutions fail to provide what is needed to support success in science and engineering fields.

In spite of educational inequalities, women of color express strong interest in science and engineering fields and greater intention to major in these fields in postsecondary study than do White females (NSF, 2009; Riegle-Crumb & King, 2010). Yet the effects of sex differences in intention to major in science and engineering continue to favor URM males over URM females. In addition, there are also strong differences by field, with URM women less likely to declare intention to major in engineering and more likely to pursue a major in life, social, or behavioral sciences (NSF, 2009).

These data suggest that the programs that the attendees of the conference called for that were aimed at raising interest and increasing awareness in science and engineering fields have indeed worked. For example, the development of career materials, like Hall's *A Day's Work? A Life's Work!* (1987), were intended to feature aspects of the lives and careers of minority women scientists. These provided a guide for other women of color in the field. Additionally, the establishment of professional groups like the Minority Women in Science (MWIS) network (founded in 1979) provided a means of connecting women of color in science together for the purposes of mentoring and advocacy efforts. The struggle has now shifted to institutions' lack of response to this growing interest, specifically their failure to take advantage of it and retain this pool of talent.

Race, Gender, and the Pathways to STEM

Since the publication of *The Double Bind*, our understanding of the route to STEM for all students, and minority women in particular, has evolved. Community colleges, master's degree–granting colleges, universities, minority-serving institutions, and even for-profit institutions play an increasing role in the collegiate experiences of STEM degree holders and members of the science and engineering workforce. Many of these changes are attributable to the substantial increases in college participation rates over the previous three decades and the growing student enrollments at all of these types of institutions (Astin & Oseguera, 2004; Snyder & Dillow, 2010). However, in all likelihood, equally responsible are the stratified patterns of postsecondary educational access for women and minorities, which indicate that minority women are participating in alternative pathways. Thus, the need to provide quality collegiate, career, and technical STEM instruction in these unconventional institutional settings is growing in importance—particularly for minority women.

Indeed, the patterns of participation in postsecondary education are very much shaped by race and sex. Underrepresented minorities and women are more heavily concentrated in community colleges and less selective comprehensive master's colleges and universities than their White and male counterparts, and racial/ethnic minorities are also significantly more likely to attend for-profit institutions (Snyder & Dillow, 2010). Among STEM bachelor's degree holders, low-income students, women, and URMs are more likely to have earned an associate's degree at a community college prior to earning a baccalaureate degree (Malcom, 2010). It is not surprising, then, that a shift in the discourse regarding broadening participation in STEM among underrepresented populations has accompanied these changes in the ways in which students access STEM. The "leaky pipeline," which emphasizes the attrition of underrepresented populations from the perceived rigid, single route to a STEM degree, has in large part been replaced by the concept of *multiple pathways.*

In the pipeline analogy, college enrollment, STEM major selection, bachelor's degree attainment, graduate school enrollment, and, finally, advanced degree attainment represent the points at which "leaks" occur, and URMs are "differentially drained" from the talent pool (CEOSE, 2004, p. ix). Although this analogy has been invoked commonly in the past, likening the problem of the underrepresentation of minority women in STEM to a leaky pipeline emphasizes student-level characteristics, such as ability, self-efficacy, and motivation, as the primary causes of attrition and minimizes the active role that higher education institutions play in the retention of minority women science and engineering majors (CEOSE, 2004). While individual-level characteristics are indeed important to the attraction, retention, persistence, and ultimate educational attainment of minority women in STEM fields, the varying degree of success that minority women in STEM realize by institutional type and whether they are enrolled in minority-serving colleges or universities suggest that institutions and their cultures, climate, policies, and practices matter (Chang, Cerna, Han, & Saenz, 2008; NSF, 2009; Solórzano, 1995; Wolf-Wendel, 1998). In addition to recognizing the multiple means by which students access postsecondary education, the pathways metaphor highlights the role of institutions in shaping underrepresented students' participation and outcomes in science and related fields while acknowledging the importance of institution-specific contextual factors that often constrain the acquisition of resources and opportunity and inhibit student success (Perna, 2006).

At the time of the publication of *The Double Bind*, much of the focus on those overt barriers to participation and success in STEM fields was placed on four-year institutions. However, current data on community college enrollment and associate degree attainment suggest that minority women face unique barriers in two-year institutional contexts. Between 2000 and 2008, more than one and a half times as many URM women were enrolled in community colleges than URM men; however, URM men earned 20 percent more associate's degrees in science and engineering than URM women (NSF, 2009). More URM women than URM men earned associate degrees in fields termed "science and engineering technologies," but this numerical advantage is entirely attributable to the relatively large number of URM women earning associate degrees in allied health fields (NSF, 2011). These data seem to suggest that a better understanding of the ways in which the intersection of race and gender contribute to the high concentration of minority women in community colleges as well as the individual and institutional factors that may stand as obstacles to their choosing *and* succeeding in STEM fields is needed. In addition to identifying the pathways traveled by minority women who succeed in STEM, additional research is needed to eliminate the barriers erected by postsecondary institutions and higher education policy (e.g., financial aid policy) and to increase the efficiency of "unconventional" routes to STEM.

Disciplinary Stratification and STEM Degree Attainment

In the thirty-five years since the publication of *The Double Bind*, minority women have made great strides in terms of STEM degree attainment; however, the extent of this progress varies widely by discipline. In 1975, for example, minority women earned just 0.6 percent of the nearly sixteen thousand science and engineering doctorates awarded to U.S. citizens and permanent residents. By 2008, African American, Latina, and American Indian women's collective share of the more than twenty thousand STEM bachelor's degrees awarded to U.S. citizens and permanent residents had risen to 6.4 percent (NSF, 1994, 2009). These data suggest that the organized efforts to increase minority women's access to, awareness of, and academic preparedness for STEM degree programs called for by *The Double Bind* conferees have indeed borne fruit. However, a closer and more critical examination of the data reveals that the progress of minority women has been uneven and inconsistent and that disturbing patterns of racial and gender stratification by STEM discipline persist.

Many of the gains realized by the Double Bind Daughters are attributable to the large increases in the proportion of social and behavioral science doctorate degrees earned by this population. In 1975, minority women earned 1 percent of doctorates in the social and behavioral sciences and more than 10.5 percent of these degrees in 2008. However, minority women's share of doctorates in computer science went from zero in 1975 to only 2.1 percent in 2008 (this corresponds to just fourteen minority women). Similarly, in 1975, no minority women earned an engineering doctorate compared to ninety-one in 2008 (only about 2.9 percent of the total number of engineering doctorates awarded to U.S. citizens and permanent residents) (NSF, 2000, 2009). The pattern is similar in physics, the geosciences, and mathematics and statistics. Why has progress been so uneven? We argue that the relatively small gains in computer science, engineering, and other math-intensive STEM fields reflect the fact that many of the barriers faced by minority women pursuing science and engineering degrees are department- and discipline-specific and originate from the rigid cultures, structures, and lack of faculty diversity in these fields.

The attendees of *The Double Bind* conference boldly called for the establishment of programs to address the underrepresentation of minority women in science, and many targeted interventions followed. Such interventions, however, often aimed to "fix the student" and did not seek whole-scale cultural change at the institutional, departmental, and faculty levels (Fox, Sonnert, & Nikiforova, 2009; Sturm, 2006). For example, numerous institutional-level programs have been developed to facilitate women's socialization to science and engineering disciplines, build their self-confidence, and correct their assumed academic deficiencies (see Fox et al., 2009). Though the strategy to arm minority women with the knowledge and tools necessary to persist in inhospitable and "chilly" climates of STEM departments resulted in measureable progress, it has also proven insufficient to bring about racial and gender equity in all STEM fields. In addition, as the legal challenges to such targeted programs grew, it became difficult to address the contextual factors that were needed to support their educational and career success absent mainstreamed efforts to create a supportive community. In the wake of *Adarand Constructors v. Peña* (1995), *Gratz v. Bollinger* (2003), and similar federal and state court decisions, funding agencies (e.g., NSF) and higher education institutions have eliminated many targeted fellowship, recruitment, and admissions programs intended to provide financial and academic support for minority students (AAAS, 2010; Malcom, Chubin, & Jesse, 2004). Though these court decisions did not pertain to STEM programs specifically, they, along with voter-driven propositions to eliminate the consideration of race in admissions to public institutions in California, Texas, Michigan, Washington, and other states, raised fears that targeted programs related to broadening access and participation in STEM would not withstand legal challenge (Malcom et al., 2004). A great deal of empirical research suggests that until such cultural and structural changes at the institutional and departmental levels take place, minority women may continue to be "stuck in the double bind" in a number of STEM fields.

Minority Women and Minority Men: Upsetting the Gender Balance

In the sciences and engineering, as in all fields, minority women have made considerable progress relative to their minority male counterparts. In 1975, women earned just below 20 percent of all doctorates awarded to African Americans, Latinos, and American Indians. By 2008, this figure had risen dramatically, to more than 57 percent (NSF, 2000, 2009). White women, however, continue to earn less than half of STEM doctorates awarded to the White population. Though the fact that minority women earn a majority of STEM doctorates awarded to underrepresented minorities appears to be positive on its face, much of this progress is an artifact of the minority male crisis in higher education; there is a significant decline in participation levels and degree attainment, especially among African American males (Harper & Harris, 2010; Snyder & Dillow, 2010). For example, African American women achieved parity with their male counterparts in receipt of MD degrees in the late 1980s; but these women now constitute a supermajority, receiving over 66 percent of total MDs awarded to African Americans in the class of 2010 (AAMC, 2010). College enrollment and achievement for minority men has stagnated, and in some cases regressed, in recent years. Tensions have arisen in some corners over the need to address the plight of minority males as *opposed* to continued focus on the needs of minority females. Both efforts are needed. Why the loss of minority males in higher education *and* why the field differentiation and failure to advance for minority women? Continuing to seek equity for minority women in the STEM fields does not automatically disadvantage minority men (Harper & Harris, 2010). For example, culturally appropriate STEM outreach in minority communities would benefit men and women, as would improvements in undergraduate instruction, particularly in introductory math and science course work (Committee on Science, Engineering, and Public Policy, 2011). Rather than adopt a zero-sum perspective, we argue that a greater understanding of the barriers faced by minority women in postsecondary institutions and STEM departments and beyond can result in positive changes for minority men as well.

Minority Women Faculty in U.S. Colleges and Universities

In the original publication of *The Double Bind*, a great deal of emphasis was placed on increasing the number of minority women postsecondary faculty in STEM fields. Doing so, it was believed, would result in a greater number of role models for minority women (and for minority men and White women) undergraduate and graduate students pursuing STEM, thereby facilitating their retention, persistence, and degree completion. Census data from 1970, the only faculty data available at the time of the publication of the report, reveal that just over 1,400 minority women taught in the STEM fields in U.S. colleges and universities. It is unclear from the data whether these minority women faculty members were full-time or part-time, on or off the tenure track. The type of institution at which they taught was also not reported. As a result, it is difficult to characterize the changes in the status of minority women faculty since the publication of *The Double Bind.* However, there are some key trends in recent data on minority women STEM faculty that bear mentioning.

In 2003, full-time minority women STEM faculty in all postsecondary institutions numbered just under nine thousand, and there were slightly more than six thousand part-time minority women STEM faculty (U.S. Department of Education, 2008). In terms of absolute numbers, there appears to have been a great deal of progress in faculty hiring for minority women in STEM. A closer examination of the data reveals that minority women faculty are more likely to be employed in two-year and non-doctoral-granting four-year colleges and universities than both their White female and minority male counterparts. This trend mirrors the concentration of minority women students in the community college sector and at less selective four-year institutions. Interestingly, minority women faculty in the STEM fields are less likely to be part-time faculty than their White female STEM faculty counterparts but are more likely to be part-time than minority men faculty in STEM. Minority women STEM faculty report spending a greater proportion of time on instructional activities and a lower proportion of time on research activities than minority males within similar institutional types (U.S. Department of Education, 2008).

These trends, whereby minority women STEM faculty find themselves concentrated in the lower strata of the conventional postsecondary institutional hierarchy and spending a larger proportion of time on instruction, a less prestigious faculty activity, seem to suggest that minority women STEM faculty continue to face barriers despite their increase in numbers. Indeed, numerous studies of minority women faculty in all fields reveal a host of challenges with which they must contend, including feelings of invisibility and isolation in their home departments (Turner, 2002; Turner & Myers, 2000), challenges to their authority, teaching competency, and scholarly expertise in the classroom environment (Harlow, 2003; Pittman, 2010), and the emotional toll of negotiating potential gendered racism in a wide range of academic settings (Settles, Cortina, Malley, & Stewart, 2006; Turner, 2002; Turner & Myers, 2000). However, additional research is needed to better understand the nature of the barriers faced by minority women STEM faculty in a range of institutional settings as well as the factors that lead them to community colleges and non-doctoral-granting institutions at higher rates than White females and minority men. Further, institutions of all types need to establish sustainable, empirically based activities to support the professional advancement of women faculty in STEM.

The More Things Change . . .

When working at its best, the system for making a scientist, engineer, mathematician, or biomedical professional involves establishment of a mentor-protégé relationship wherein one is guided as he or she progresses toward and into the career. It is in such an arrangement that one is introduced to the big ideas, codes of conduct, ways of working, systems of reward, culture, traditions, and so on of a field that shapes a particular community of scholars. One finds a place, at some point being able to see oneself and to be seen as part of this community. Investing in the development of an individual student or early career professional may be clouded by stereotyping or by a singular focus on past performance on an uneven playing field as opposed to consideration of capability and potential. Cultivating a supportive, reciprocal relationship with a mentor, who recognizes the value brought by the student, can do more to level the playing field than any other single intervention (Haring, 1999).

The authors of *The Double Bind* wrote about the high cost of studying and pursuing careers in STEM, noting that the more an individual deviates from the typical professional in terms of degrees of "different-ness," the greater the price he or she pays. Individuals who do not fit the stereotypical mold of a scientist (e.g., women, underrepresented minorities) have to cope with distance from their colleagues and their communities. Their racial/ethnic and gender identity makes them different from their colleagues, while their identification as a scientist may make it difficult to fit in with their communities. Further, while minority women in science may take on additional burdens due to the fact that they are looked to as role models by women and minorities interested in pursuing STEM, the time invested in fulfilling that role is not often valued or rewarded in their institutions or in their departments. It is perhaps this aspect that makes the attainment of success in STEM so difficult for minority women. They are at once highly visible and invisible.

When the conference was originally conceived and planned in 1975, Asian American women were not represented. Since it appeared that they were not underrepresented among STEM degree holders and within the STEM workforce, the funder was reluctant to support their inclusion. Today we understand that some Asian populations (e.g., Southeast Asians, Pacific Islanders) are indeed underrepresented (Ngo, 2006). It is also clear that Asian American women face challenges to advancement and recognition that resemble the challenges of URM women.

In order to understand the true nature of the obstacles faced by minority women in STEM, we need data disaggregated by race and by sex as well as by field and institutional type. But their small numbers are driving statistical agencies to suppress the very information we need to inform our programs, policies, and practices as well as to inform efforts to improve the conditions for URM males in STEM fields. While respecting the privacy concerns that lead to these decisions, it is important to understand that this information provides much needed context for the crafting of public policy aimed at broadening participation in STEM, and this need should drive us toward compromise. Users of these statistics, such as advocacy communities, might suggest more appropriate aggregations of data (e.g., by broad field, by fields with similar profiles, across years) to statistical agencies or, as a trade-off, recommend elimination of public disclosure of certain private data (e.g., salary information). These compromises might satisfy both privacy and compelling interest concerns. There is a certain irony in the call for evidence and research-based strategies at a time when support to develop this base is not forthcoming.

It is our hope that this symposium will lay out the issues and research questions to be considered as we move forward. It is also our hope that the challenges of the past will not be the legacy that we leave to the next generation of minority women who seek education, careers, and a life in science, engineering, mathematics, or biomedicine.

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