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Toward a Framework for Multicultural STEM-Focused Career Interventions

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Abstract

Numerous federal and national commissions have called for policies, funds, and initiatives aimed at expanding the nation's science, technology, engineering, and mathematics (STEM) workforce and education investments to create a significantly larger, more diverse talent pool of individuals who pursue technical careers. Career development professionals are poised to contribute to the equity discourse about broadening STEM participation. However, few are aware of STEM-related career development matters, career opportunities and pathways, or strategies for promoting STEM pursuits. The author summarizes STEM education and workforce trends and articulates an equity imperative for broadening and diversifying STEM participation. The author then offers a multicultural STEM-focused career development framework to encourage career development professionals' knowledge and awareness of STEM education and careers and delineates considerations for practice aimed at increasing the attainment and achievement of diverse groups in STEM fields.

Keywords

career development; STEM; career interventions; underrepresented minorities

There is an urgent need to improve the educational and career development of individuals to work in science, technology, engineering, and mathematics (STEM) fields. According to the Brookings Institution, 30% of job openings in the average large metropolitan U.S. city are in STEM fields, but there are too few qualified workers to fill them (Rothwell, 2012). STEM fields are vital to the social and economic condition of the country, contributing innovations that improve living conditions (e.g., health care, clean energy) and accounting for more than half of the country's sustained economic growth for the past 50 years (Babco, 2004). Given the societal and economic contributions of STEM fields, it is not surprising that promoting STEM fields and increasing the number of STEM workers are at the forefront of most national policy discussions.

In reports from several federal and national commissions, including *Rising Above the Gathering Storm* (National Academy of Sciences, National Academy of Engineering, &

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Institute of Medicine, 2007), *Why So Few?* (American Association of University Women [AAUW], 2010), *Beyond Bias and Barriers* (National Research Council [NRC], 2007), and *Expanding Underrepresented Minority Participation* (NRC, 2011), a clear consensus has emerged regarding what the United States must do to develop and prepare workers for STEM jobs. These commissions, their stakeholders, and the White House have called for new funds and initiatives to expand both the STEM workforce and educational investments to create a larger, more diverse pool of individuals to pursue STEM fields, with attention to increasing racial/ethnic and gender diversity (National Science and Technology Council [NSTC], 2013).

Much of the emphasis and hope for motivating individuals toward STEM has been focused on K–12 and postsecondary formal and informal educators, including out-of-school programs to increase STEM participation. Ironically, little has been said or mentioned about the role of career development professionals (CDPs) in the discourse on broadening STEM participation. CDPs are trained to facilitate career-related exploration, preparation and training, and workforce development. However, these professionals may not be aware of the value of promoting STEM opportunities or strategies for doing so.

The purpose of this article is twofold: (a) to increase CDPs' awareness of academic and career trends in STEM and the need for STEM-focused career intervention and (b) to promote culturally relevant interventions aimed at broadening the participation of all groups in STEM. To achieve these purposes, I articulate a multicultural STEM-focused career intervention framework for CDPs to (a) support their knowledge of STEM careers, (b) delineate several relevant skills and practices aimed at increasing STEM access and attainment for culturally diverse groups, and (c) encourage their intentionality in exploring collaborations with STEM stakeholders to facilitate STEM career development opportunities. The first half of the article focuses on the rationale for a multicultural STEM-focused career development agenda and calls for a paradigm shift toward an equity imperative in STEM talent development. The second half of the article describes the framework's content in three general areas for CDPs to consider: awareness, communication, and skills. Before I present this rationale and framework, it is important to define CDPs and STEM.

Defining CDPs

On the basis of Whiston and Blustein's (2013) definition, I refer to CDPs as professionals who include doctoral-trained counseling psychologists and counselor educators; master's-trained career counselors, school counselors, mental health counselors, and rehabilitation counselors; and paraprofessionals with training from the National Career Development Association designated as career development facilitators. CDPs have training in theory and research in counseling; career development, human development, and personality development; counseling methods; ethics; and multicultural issues. They work with individuals across the life span at varying career junctures (e.g., exploration, job entry, advancement) and are, therefore, positioned to contribute to the goal of building a diverse STEM workforce.

Defining STEM

No standard definition exists of what constitutes a STEM job. All definitions include the jobs engaged with research and development (R&D)—the workforce sector directly producing new technologies and scientific discoveries. Although there are some exceptions, health care, social science, business, and technical support professions outside the fields of engineering, mathematics and computer science, and the physical and life sciences are generally excluded as STEM fields.

The U.S. Department of Commerce recently defined STEM jobs, listing 50 occupations that include professional and technical support occupations in four categories: computer sciences and mathematics (e.g., systems analyst, statistician); engineering and surveying (e.g., biomedical and materials engineers); physical, life, and geosciences (e.g., chemist, environmental and medical scientists); and STEM managerial occupations (e.g., engineering and natural sciences managers; Langdon, McKittrick, Beede, Kahn, & Doms, 2011). Another definition by Carnevale, Smith, and Melton (2011) included technicians and clustered STEM occupations into five major subcategories: computer occupations; engineers and engineering technicians; mathematical science occupations; life and physical science occupations; and architects, surveyors, and technicians. Detailed descriptions of STEM occupations and job titles can also be found on the O*NET (Occupational Information Network) website (www.onetonline.org; select “Find Occupations,” then select “STEM Discipline”).

The Need for Multicultural STEM Career Development

On October 4, 1957, the former Soviet Union launched the first artificial satellite called Sputnik. That historical moment was transformed into a movement that led the United States to create the National Aeronautics and Space Administration (NASA) by July 1958 and pass the National Defense Education Act (NDEA) in September 1958 (Garber & Launius, 2005). The NDEA provided funding for scientific research, to educational institutions across all levels (primary through postsecondary schools), infusing American schools with a new emphasis on science and technology, and established counseling and guidance training institutes to train counselors to identify and steer individuals toward college STEM majors (Jolly, 2009). Responding to what he called “our generation's Sputnik moment” (White House, 2011, para. 26), President Barack Obama began the Educate to Innovate initiative in 2009 to improve the nation's participation in STEM education and careers, particularly for youth and for groups underrepresented in STEM, such as women and racial/ethnic minorities (White House, n.d.). The initiative includes efforts such as after-school STEM programs; STEM AmeriCorps volunteers to mentor others into STEM; and the improvement of postsecondary STEM education, with an emphasis on diverse pathways to STEM degrees.

Three perspectives generally capture the present need for a STEM-competent, culturally diverse workforce and warrant CDPs' focus on multicultural STEM career development. First, from a labor market perspective, job growth in STEM fields is expected to be high: 17% compared with 10% for total job growth in the labor market with more than 2 million job openings forecasted between the years 2008 and 2018 (Carnevale et al., 2011; Langdon et al., 2011). Second, from a demographic perspective, women, racial/ethnic minorities, and older individuals are increasing their share of the labor force (Toossi, 2012). However, women and racial/ethnic minorities, including African Americans, Latinos/as, and Native Americans, are grossly underrepresented in STEM, particularly in specialized fields such as biomedical research and computer science (Froeschle & Normington, 2010). Women and racial/ethnic minorities hold less than 25% and 9% of STEM jobs requiring a college education, respectively, and are thus considered underrepresented minorities in STEM occupations (Beede et al., 2011; NRC, 2011). A group is considered to be underrepresented when its numbers in a given field are disproportionately lower than its numbers in the general population. For instance, Latinos/as are 16% of the U.S. population and 16% of the total workforce, but they compose only 6% of the STEM workforce (Carnevale et al., 2011; Ennis, Ríos-Vargas, & Albert, 2011). Underrepresentation is not a problem in itself. If the world of work was a level field such that individuals could make an occupational choice on the basis of their interests or skills, then each individual would be drawn to some occupations over others. However, if systemic barriers and obstacles prevent some groups from making career choices with the same range and freedom as other groups, then this is a concern for the people with whom CDPs work and CDPs' workforce efforts (Byars-Winston, Fouad, & Wen, 2013). Restricted and foreclosed STEM academic and career opportunities for certain individuals result in the loss of human talent from some occupations that consequently do not benefit from the contributions of a diverse labor force (Leung, Maddux, Galinsky, & Chiu, 2008).

Finally, from a pipeline perspective, despite significant federal investments in STEM-related education and workforce training to engage more people in STEM ($3.4 billion spent in fiscal year 2010; NSTC, 2011), troubling statistics exist regarding individuals' attraction to, entrance in, and persistence in STEM. One survey of high school students found that approximately half were interested in pursuing STEM careers; the other half not interested in STEM, which was composed of a large percentage of African Americans and Latinos/as, reported not knowing enough about STEM careers or feeling incompetent in STEM school subjects as obstacles to pursuing those career paths (University of the Sciences, 2012). At the college level, nearly 60% of 1st-year students aspire to major in STEM, but only 40% of those students earn STEM degrees (President's Council of Advisors on Science and Technology, 2012). For those who do complete a STEM bachelor's degree, 43% do not work in STEM after graduation; and for those who do enter STEM fields, 46% have left these fields 10 years later (Carnevale et al., 2011). Attrition from the STEM workforce is higher and more complex for women and racial/ethnic minorities (Carnevale et al., 2011).

There are myriad root causes for underrepresentation and attrition in STEM that can affect anyone at every academic and career juncture, including individual differences in career preferences, inadequate science and mathematics academic preparation, poor STEM classroom experiences, a lack of peer supports, market value of STEM skills to non-STEM occupations, and inadequate mentoring for career advancement (AAUW, 2010; National Alliance for Partnerships in Equity [NAPE], n.d.-b). Nonetheless, despite initial connections to STEM, underrepresented minorities are systematically more likely to become disconnected from these fields (Byars-Winston, 2013).

Extensive research in STEM underrepresentation shows that under-represented minorities' attraction to and achievement in these fields are influenced by more than just ability. Table 1 presents several studies that reveal a pattern of academic and work environments that may be unwelcoming to underrepresented minorities and in which they encounter cultural stereotypes and discrimination. Conspicuous minority status, due to being one of only a few underrepresented groups, can lead to cultural isolation, a low sense of belonging, and self-doubt for under-represented minorities despite a strong motivation to pursue STEM (Carlone & Johnson, 2007; Ong, 2001). One's conspicuous minority status can also elicit the experience of stereotype threat, which is the fear of confirming negative stereotypes about one's social group as a result of one's individual performance (Steele, 2010). All individuals have social identities based on many factors, such as their race/ethnicity, gender, ability status, and age, and those identities come with a set of expectations, generalizations, and stereotypes. When confronted with the negative stereotypes, such as reminding women before a math test that women are not expected to do well, members of the negatively stereotyped group perform worse at a task; remove the threat to their identity, and they perform well (Good, Aronson, & Harder, 2008).

Other research summarized in Table 1 indicates that some underrepresented minorities experience negative judgments from others about their intellectual competence and, consequently, feel the need to prove their abilities in STEM (Hurtado, Cabrera, Lin, Arellano, & Espinosa, 2009). Some individuals may also experience their STEM identities to be in conflict with other social identities, such as gaining recognition as a scientist and as a woman (Johnson, Brown, Carlone, & Cuevas, 2011). Byars-Winston, Estrada, Howard, Davis, and Zalapa (2010) found that cultural dynamics, such as comfort with other racial/ethnic groups, are related to STEM academic self-perceptions, which, in turn, shape the academic goals that can lead to eventual STEM-related behaviors. It is worth noting that the cultural factors discussed in this section affect STEM academic contexts and STEM workplaces (Fouad, Fitzgerald, & Liu, 2011).

In summary, research illustrates that cultural factors are relevant to understanding underrepresented minorities' participation in STEM. The experience of being a member of an underrepresented or devalued minority group can trigger environmental responses from and to others that can thwart one's sense of belonging, identification with STEM, and belief in one's STEM abilities and potentially undermine the interest and performance of underrepresented minorities in STEM domains.

A STEM equity Imperative

The persistent underrepresentation of minorities is partly due to the focus on a narrow group of individuals to enter the STEM pipeline, that is, the best and brightest individuals in STEM (see National Science Board [NSB], 2010), which I view as the traditional talent search approach. Alternatively, I propose that a talent development approach be taken to nurture and recognize STEM potential, especially for those who have had fewer or inadequate opportunities to transform their potential into STEM achievement (NSB, 2010). This talent development approach is rooted in a fundamental value that equitable opportunities for career development should be supported so that all individuals can reach their full workforce potential and thrive.

Underlying the talent development approach to broadening and diversifying STEM participation is an equity imperative, which is needed to address the myth of meritocracy that permeates national ideology in general and STEM disciplines in particular. The meritocracy myth suggests that the United States is an equal society in which people will have a quality of life proportional to their efforts, innate talent, and moral character (cf. McNamee & Miller, 2004). Yet, overwhelming evidence from decades of social science and legal studies documents that life opportunities, including educational and occupational opportunities, are socially constructed and unevenly distributed (McNamee & Miller, 2004; Rossides, 1997).

Most career development theories acknowledge that people do not end up in careers by chance, but rather that the work that they do is a result of interacting individual, social, and environmental factors. Still, many people view the lack of underrepresented minorities in STEM fields as indicative of their lack of ability, drive, or interest (AAUW, 2010). However, research has found that African American high school girls' interests in STEM school subjects are higher than those of their White counterparts (Hanson, 2009), intentions to major in STEM are similar between racial/ethnic minority undergraduates and White undergraduates (NSB, 2012), and ability is not a primary factor in STEM persistence or attrition given that highly capable students leave STEM (Seymour & Hewitt, 1997). Failure to address the incongruence between the ideology of equal STEM access and opportunity and the actual disparities in STEM participation allows the beliefs and assumptions that reproduce the gendered and racial/ethnic order (Solomon, Portelli, Daniel, & Campbell, 2005) in STEM fields to remain unchecked.

Some unchecked assumptions and myths about STEM entry include views that science is a calling and that STEM talent and interests come early in life. Margolis and Fisher's (2002) research on women in computer science found that three quarters of men displayed an early and intense attraction to computer science in contrast to approximately one quarter of the women. Thus, an immediate attraction to STEM early in life is true for some but not for all. However, because success in STEM is often based on a stereotype of a common male pattern such as the one found in Margolis and Fisher's work, STEM culture by default assumes that men will succeed. Such stereotypes shape the assumptions of “who ‘belongs' in the discipline” (Margolis & Fisher, 2002, p. 71) and disadvantage not only women but also men who may not follow a presumed pattern of STEM participation.

Critical race and critical feminist theories (Delgado & Stefancic, 2012) interrogate and challenge the seeming natural order of things in society and are thus useful in supporting a STEM equity imperative. Such theories invite questions for consideration, such as “How does STEM participation become gendered, and how does it become raced?” and “How does the current disparate involvement in STEM benefit White privilege and male privilege, and who benefits if nothing changes?” These perspectives expand the explanation of disparities in STEM involvement from a typical focus on individual factors to a focus on unequal STEM opportunities and resources across demographic groups.

By virtue of their training in career development theory and interventions and a historical emphasis on individuals' strengths rather than deficits (Romano & Kachgal, 2004), I argue that CDPs are uniquely poised to be STEM talent development facilitators. They are in position to expose, inform, and motivate clients to pursue and persist in STEM fields and, thus, can play a pivotal role in shifting the traditional paradigm in STEM participation from talent search to talent development. The origins of the career counseling profession are rooted in social justice tenets and are reflected in multicultural career counseling values (K. M. O'Brien, 2001). However, advancing STEM participation requires more than personal enlightenment associated with embracing multicultural values. It requires equity-focused actions informed by multicultural career counseling values to remedy factors that contribute to uneven STEM involvement. Indeed, social justice activities can be embedded within career development interventions and carried out through career development interventions. Solomon et al. (2005) asserted that multicultural discourse should be considered the “starting point not the terminal space” (p. 165) for realizing equity, because the latter requires a critical interrogation of systems and institutional practices that contribute to inequities. Similarly, the word *multicultural* in the framework described in the next section signals a starting place for CDPs' intentional engagement in equity-oriented STEM career interventions.

A Multicultural STEM-Focused Career Interventions Framework

Figure 1 presents a framework for multicultural STEM-focused career intervention. The framework is intended as a broad description of relevant issues to be considered in advancing an equity-focused STEM career development agenda, rather than a series of steps to be followed. It is grounded in research on underrepresented minorities' STEM academic and career development as referenced in Table 1. It is also informed by tenets of social cognitive career theory (Lent, Brown, & Hackett, 1994), with attention to factors that support positive academic and career-related self-perceptions relative to STEM. The framework begins with a focus on increasing CDPs' awareness and knowledge of the occupational landscape, career opportunities, and pathways in STEM fields. Next is consideration of CDPs' communication about STEM fields to the various constituencies with whom they work. Finally, the framework targets skill development to broaden STEM participation. Particular attention is given to the relevance of cultural factors as significant career influences throughout the framework. Although the focus is on cultural factors identified in STEM studies as salient for White women and racial/ethnic minority men and women, the cultural factors discussed here may be relevant for other underrepresented minority groups in STEM, such as people with disabilities.

Counselor Awareness of STEM

CDPs should increase their awareness regarding STEM matters in several areas. According to Arredondo et al. (1996; Sue, Arredondo, & McDavis, 1992), multiculturally competent practice necessitates that counselors first examine their personal cultural values and biases. Thus, to start, CDPs need to be aware of how their personal experiences shape their views of work and career development, especially their assumptions and images of who is in STEM. For example, myths persist that female underrepresentation in STEM leadership positions is due to innate gender differences in biology and intrinsic aptitude and women's reluctance to work an 80-hour week, for example, as stated by former Harvard President Lawrence Summers in 2005. These stereotypes and beliefs often operate as habits of mind that can translate into biased actions of which the individual may not be aware nor have intended (Carnes et al., 2012). A necessary step to changing prevailing cultural attitudes and practices about who belongs in STEM is bringing explicit attention to implicit biases and being conscious about cultural influences on one's worldview. By increasing personal consciousness about cultural influences on their own career development, CDPs may be more attuned to cultural influences in the STEM career development of their clients.

Moreover, CDPs must be aware of how they view underrepresented minorities in STEM and challenge views they may hold of these individuals as exceptional and somehow different from most underrepresented minorities, because these views have several consequences. First, such views reinforce notions of underrepresented minorities as outsiders in STEM. Those underrepresented minorities who do achieve despite challenges are viewed as “exceptional exceptions” (Burrell, 2010, p. 4) and put on pedestals with less concern for those who do not achieve. Some underrepresented minorities in STEM may even come to believe that they are indeed exceptional. Second, such views reify the perception of STEM domains as belonging to an elite few such that these fields accommodate only the extraordinary underrepresented minorities. Finally, such views distance underrepresented minorities in STEM from underrepresented minorities who are not in STEM, with the former viewed as oddities or inauthentic members of their gender or racial/ethnic group. Thus, it is just as important that CDPs check their own views of underrepresented minorities in STEM as it is to check how underrepresented minorities view themselves in relation to STEM.

To become more aware of 21st-century STEM career opportunities, CDPs should also increase their STEM literacy by learning about STEM employment trends and opportunities (Schmidt, Hardinge, & Rokutani, 2012). Readers may refer to the STEM Career website (www.stemcareer.com; Graham, 2013) and the *Quick STEM Careers Guide* (Shatkin, 2011a) as resources for promoting STEM careers across primary, secondary, and postsecondary levels. The STEM Careers Inventory (Shatkin, 2011b) provides a self-directed assessment using Holland's (1959) RIASEC (Realistic, Investigative, Artistic, Social, Enterprising, Conventional) codes to help individuals identify and explore STEM fields. Equally important is for CDPs to be aware of STEM career trends in their local communities. Local information can be found through a state's department of workforce development or the CareerOneStop website (www.careeronestop.org; browse “What's Hot” or “Employment Trends”), sponsored by the U.S. Department of Labor.

Finally, CDPs should strengthen their knowledge of multiple academic/learning routes and pathways to STEM careers. The world of work requires a supply of skilled individuals in fields from the most complex R&D and leadership positions for production, repair, sales, and other jobs that require competencies built upon STEM knowledge. It is estimated that 35% of STEM jobs will be available to individuals with less than a bachelor's degree by the year 2018 (Carnevale et al., 2011). A large segment of the workforce in industries and occupations that rely on STEM knowledge and skills is composed of people who enter and advance in their field through subbaccalaureate degrees, vocational training, apprenticeships, industry-based certifications, or workplace training. The Career InfoNet website (www.careerinfonet.org) allows individuals to locate training opportunities by region, state, or zip code (select "Career Tools," then "Education & Training Finder"), and the website of a career technical education consortium lists available STEM credentials (www.careertech.org; select "Career Clusters Resources," then "Credentials").

Communication About STEM

Not everyone is convinced about the significance of STEM literacy for all or the need for investments to advance the STEM talent development agenda to ensure that a highly qualified workforce is available to meet current and future demands. A survey of parents and students revealed that although they viewed STEM fields as vital to the nation's economy, they did not view improving STEM education as a pressing matter (Kadlec & Friedman, 2007). So, how can CDPs demonstrate why STEM matters? What is the STEM message to be communicated, and how might it be developed and delivered? To begin, CDPs should identify what the real problems are facing their individual clients, local business stakeholders in STEM, and their general communities (National Governors Association, n.d.), and then consider culturally relevant ways to communicate about STEM opportunities. For instance, CDPs pitching the relevance of STEM education to employers may emphasize potential partnerships with local workforce training and retraining opportunities to fill vacant jobs with diverse STEM talent, whereas CDPs working in economically depressed regions may pitch STEM education to the local community as offering a pathway out of poverty.

CDPs might consider the persuasive power of a story in their communications regarding STEM. Persuasive storytelling is commonly and effectively used in public health campaigns to convey health information in an easily understood manner (Gray, 2009), such as the risks of tobacco use or HIV awareness. Working with local STEM industries or nonprofit groups, such as unions and professional associations, to develop case studies or career biographies of STEM workers can provide CDPs with concrete, relatable examples of STEM occupations and of diverse STEM pathways to share with clients and serve as resources for future career explorations (e.g., site tours, job-shadowing opportunities). Here, it is useful to include present-day examples of culturally diverse STEM professionals who, despite challenges, have been successful.

Next, credibility is key to developing selling points for STEM, and CDPs can demonstrate credibility not only by having influence to help clients to access STEM opportunities, but also by having insider knowledge about STEM trends and work opportunities. This insider knowledge can be gained by accessing up-to-date information already collated by local and regional organizations, which may be used to communicate about STEM through various forms of social media (e.g., web posts, e-mail blasts to clients) or the development of "Did you know?" materials. Two groups that daily synthesize STEM information, including web casts and policy matters, are (a) Teach for America's STEM Initiative (https://twitter.com/TFA_STEM), which has a Twitter account with daily posts of national STEM-relevant data and activities, and (b) STEMconnector (www.stemconnector.org), which offers a daily enewsletter on STEM in K–20+ education, workplace, and government; funding opportunities; editorials; town-hall conference calls; publications on diversity; and state-level STEM data.

Finally, to answer the question “What can STEM do for you?” CDPs must tailor their communications about STEM to address the needs of different communities. The National Governors Association (n.d.) produced a STEM communications toolkit, including a template for developing core STEM messages, sample press releases, and frequently asked questions for guidance when interacting with various constituencies.

Counselor Skills and Practice

The counselor skills and practice dimension of the proposed framework comprises two components. One component deals with developing culturally diverse talent in STEM. The other component concerns developing STEM partnerships and opportunities.

Diversity talent development—Horticulturalists apply science to cultivating plants and flowers, with particular attention to plants and soil systems. Similarly, CDPs can focus on cultivating more diverse STEM talent by attending to individual factors (plant systems) and sociocultural contexts (soil systems) that influence clients' career choices. To begin, CDPs might examine what they focus on in their interventions: talent search or talent development? That is, do their interventions reflect a seeding (i.e., talent development) or a weeding (i.e., talent search) emphasis? The world is replete with examples of individuals who found their vocational calling because someone recognized their potential and suggested a new avenue for them to consider; in effect, a seed was planted that germinated into a person realizing a vision for her or his life through work beyond what she or he had previously conceived.

In addressing individual-level factors (i.e., plant systems), CDPs should use interventions that broaden individuals' knowledge of what STEM careers are, increase the visibility and enjoyment of STEM fields, and build confidence and resilience in STEM contexts (Byars-Winston, 2010, 2013; Diekman, Brown, Johnston, & Clark, 2010). Broadening clients' knowledge of STEM careers requires CDPs to think about STEM opportunities outside of traditional R&D jobs: STEM fields need advertising, social media managers, new approaches in marketing and public relations, and legislative lobbyists. CDPs may raise awareness of the range and diversity of STEM jobs by having clients keep a diary of how STEM jobs affect their daily lives, such as getting out of bed (e.g., textile development and testing of mattress) and eating breakfast (e.g., food science and processing; Department for Education, 2011), or by organizing a STEM careers speed-dating session in which STEM professionals share occupation-specific information and individuals can ask their “date” quick career questions in a short time to raise awareness; with 7–10 minutes for each date, individuals can be introduced to six different careers within an hour.

To increase visibility and enjoyment of STEM, CDPs may reference evidence-based practices to make science more relatable to diverse groups, such as Emdin and Lee's (2012) project that integrates hip-hop and science to help urban youth see themselves as part of the science enterprise. CDPs must also challenge stereotypes of STEM occupations and workers, addressing potential implicit bias and prejudice against underrepresented minorities in STEM. Consider, for instance, how might relatability to and interest in computer science change if CDPs offered computer scientist images such as the SpelBots, the female African American robotics team at Spelman College? Attending to these cultural matters in STEM interventions is important given that integrating a STEM identity with other social identities can be an additional cultural negotiation for under-represented minorities (Johnson et al., 2011). CDPs can benefit from professional development to understand and address such issues. NAPE (n.d.-a) offers STEM equity career workshops for CDPs that provide evidence-based strategies to encourage underrepresented minorities toward STEM academic preparedness and careers.

At the contextual level (i.e., soil systems), it is important for CDPs to understand some structural and sociocultural factors that contribute to the diversion of people away from STEM. With regard to structural reasons, Melguizo and Wolniak (2012) noted that economic factors such as high transferability and market value of STEM skills to occupations outside of STEM contribute to diversion. Sociocultural reasons for diversion documented in research include unattractive working conditions, perceived incongruence between work and family demands, and a lack of belonging (AAUW, 2010). CDPs can support clients' strategies for coping with barriers and their cultural competence to learn and work in historically monocultural STEM environments, especially for under-represented minorities who often encounter inhospitable “soil.” Byars-Winston (2010, 2013) offered counseling interventions at the individual and contextual levels to build STEM efficacy beliefs, to develop career resilience, and to resist internalizing stereotypes about underrepresented minorities in STEM.

Partnerships and opportunity development—CDPs can support access to opportunities by partnering with industry, professional societies, foundations, education and training institutions, as well as civic and religious organizations connected to reaching individuals traditionally underserved in STEM. In this vein, CDPs can be boundary spanners by adopting systems-level thinking—that is, they should consider the links that can be forged across institutions and systems that would facilitate greater access to STEM opportunities for underrepresented minorities. Boundary spanning may include consulting with minority-serving organizations that offer career awareness programs, such as the Boys and Girls Clubs of America, historically Black sororities and fraternities, or local trade unions (e.g., many trades are prospecting for more female participation in construction, sheet metal working, and manufacturing). In working with K–12 educators, CDPs may partner with STEM efforts such as Project Lead the Way (Tai, 2012), providing in-service training to equip educators with knowledge of STEM careers and how to direct their students to career guidance professionals, or coordinating STEM career activities and events (e.g., National Career Development Month). Not only can such partnerships be a foundation for developing internships or positions, but they can serve to inform CDPs on developing successful STEM workers with the requisite workplace competencies (Zimenoff, 2013).

Numerous local initiatives in education, government, and industry exist with which CDPs could partner to expand STEM learning opportunities. For example, recognizing that parents are often the best allies to support their children's career development, Iowa has a university– industry partnership to host Moms Night Out for STEM, a statewide initiative to encourage primary caretakers' interest in their children's STEM education. The Colorado Department of Corrections provides an example of a government–industry collaboration that partnered with Cisco's Networking Academy to offer information technology training and certification to female offenders (Cisco, 2012). CDPs can collaborate with existing efforts such as these to support the programs' delivery and sustainability through career facilitation and follow-up interventions.

Conclusion

Meeting the national demand to grow the STEM workforce is tied to growing the STEM participation of individuals from groups who have been historically underrepresented in these fields. As key players in developing the future workforce, CDPs need culturally relevant interventions informed by career theory and research to increase equitable opportunities in STEM for all individuals across the life span (Byars-Winston, Gutierrez, Topp, & Carnes, 2011). The framework described in this article offers one guidepost, based on theory and research, against which CDPs can examine and expand their career practices and become more intentional in addressing multicultural career development. It is hoped that this framework will inspire future elaborations and innovative interventions to promote STEM academic and career development. For instance, in addition to the ideas described in the framework, what activities or strategies might increase CDPs' awareness of STEM equity matters? Ultimately, in referencing this framework, I hope that CDPs will be encouraged to contribute to the national goal of increasing the numbers and diversity of individuals participating in STEM fields.

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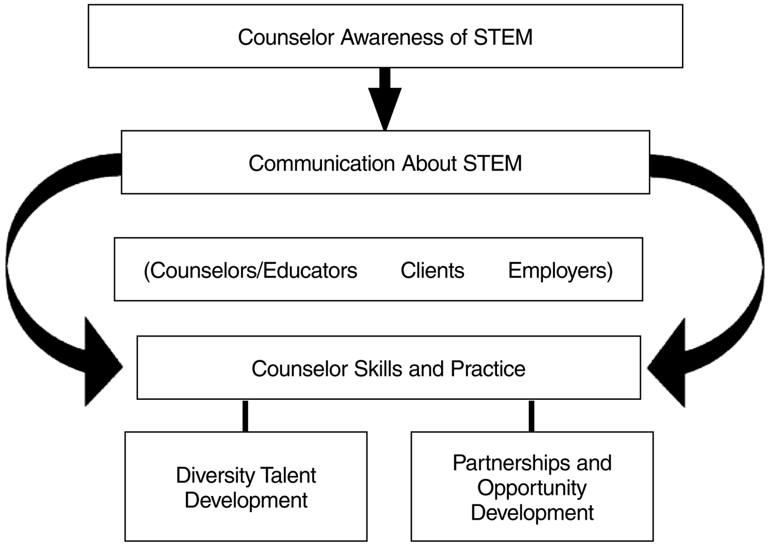

Figure 1. Framework for Multicultural STEM-Focused Career Intervention
Note. STEM = science, technology, engineering, and mathematics.

Table 1

Selected Research on Science, Technology, engineering, and Mathematics (STEM) Participation and Attainment in Underrepresented Groups

Focus of Study	Source	Finding
	Culture and Associated Values	
Cultural identity and STEM-related perceptions	Byars-Winston et al. (2010); V. O'Brien et al. (1999)	Intercultural comfort and ethnic identity positively related to academic STEM self-efficacy beliefs
Competition versus cooperation	Diekman et al. (2010, 2011); Girl Scout Research Institute (2012); Seymour & Hewitt (1997)	Competition turns some racial/ethnic minority groups off from STEM; cooperation and creativity turn them on to STEM
Lack of cultural fit	Barton et al. (2013); Malone & Barabino (2009); Tate & Linn (2005)	Differential status necessitates "identity work"
STEM identity ↔ cultural identity	Carlone & Johnson (2007); Ong (2005)	Identities in conflict; STEM recognition versus recognition as racial/ethnic minority, woman
Culture-blind attitudes in STEM	Johnson et al. (2011); Moss-Racusin et al. (2012)	Gender differences in bias against women in STEM; challenge in addressing implicit biases
View of STEM as community-relevant	Lewis & Collins (2001); Margolis & Fisher (2000)	Seeing STEM as a vehicle to make a social contribution can increase racial/ethnic minority groups' interest in STEM
	Environmental and Contextual Factors	
"Chilly climate" in STEM	Cabrera et al. (2001)	Low sense of belonging
Perceived discrimination; microaggressions	Brown et al. (2005)	Alienation; lower graduation rates (engineering)
Stereotype threat	Byars-Winston, Coover, et al. (2013); Good et al. (2008); Hurtado et al. (2009)	Motivated to "prove" STEM competence, disprove stereotypes about racial/ethnic minorities and women in STEM
Numerical under-representation in context	Harper (2010); Ong (2001)	Negotiation of "onlyness"; visibility for minority status, invisibility for STEM status
Perception of opportunity (in class, in labs, to be mentored)	AAUW (2010); Girl Scout Research Institute (2012)	Perceived barriers (working twice as hard to be taken seriously), differential access to resources, supports

Note. AAUW = American Association of University Women.