Theory Into Practice

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/htip20

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To cite this article: Erik M. Hines, Edward C. Fletcher Jr, Paul C. Harris, Jerrod A. Henderson & James L. Moore III (29 Nov 2023): Using homeplace to guide STEM identity development in Black males, Theory Into Practice, DOI: 10.1080/00405841.2023.2287740

To link to this article: https://doi.org/10.1080/00405841.2023.2287740

THEORY INTO PRACTICE
https://doi.org/10.1080/00405841.2023.2287740

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Using homeplace to guide STEM identity development in Black males

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ABSTRACT

Black males continue to be underrepresented in the fields of Science, Technology, Engineering, and Mathematics. Some of the barriers to representation are due to lack of exposure, academic expectations, lack of belief in one's ability, and opportunity gaps. The purpose of this article is to discuss how homeplace (black joy, authenticity, and freedom dreaming) can be cultivated by educators and practitioners in both K-12 and higher education. We also make recommendations for policy, practice, and research.

Given the global race to innovation and to address grand challenges, the United States must ensure its citizenry has the education and skills to compete, particularly in the fields of Science, Technology, Engineering, and Mathematics (STEM). The country's economic viability, national security, and new technologies such as artificial intelligence (AI) depend on a strong, vibrant workforce (Athansasia & Cota, 2022). However, with the United States lagging in recruiting and retaining a STEM workforce, this could lead to a shortage, thus compromising the country's ability to push new frontiers in innovation and discovery (Athansasia & Cota, 2022). Unfortunately, and all too often, certain segments of the population are excluded from engaging in STEM education. Specifically, students of color, in particular Black males continue to be underrepresented in the STEM fields (Fletcher et al., 2023; Henderson et al., 2022). Only 5% of Black individuals are represented in the science and engineering occupations while making up 12% of the workforce (National Science Board, 2018). The lack of Black male representation in STEM is due to low teacher expectations, negative schooling experiences, lack of access to rigorous coursework to enhance STEM learning, racism and bias, and little to no awareness of the career that exists within the STEM fields (Fletcher & Hines, 2022; Henderson et al., 2022; Ortiz et al., 2019). To further exacerbate the issue, Black male academic achievement such as reading and math scores tend to be lower than their White, Latinx, and Asian peers (Cintron, 2020; Fletcher et al., 2023; Ford & Moore, 2013; Hines, Mayes et al., 2021). Moreover, Black boys are underrepresented in gifted and talented programs as well as

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honors and advanced placement courses, and the International Baccalaureate program (Ford & Moore, 2013).

To help cultivate STEM identity, educators (school counselors, teachers, and administrators) and practitioners (higher education faculty and staff) must create a space to develop the gifts and talents of Black men and boys. Therefore, homeplace (hooks, 1990), must be a place where Black boys and men can bring their authentic selves, their humanity, and abilities without fear of retribution, prejudice, assumptions, and mistrust. Homeplace should be part of every educator's skillset as it incorporates a level of cultural competency in which the school or postsecondary institution becomes an environment that advocates for Black men and boys to be successful, specifically in STEM fields. As a result of homeplace, Black boys and men are free to engage in STEM; by asking questions where they feel non-judgment, educators and practitioners are invited the males to engage in projects and events without having to ask.

The purpose of this article is to discuss how homeplace (black joy, authenticity, and freedom dreaming) can be used to help develop STEM identity in Black males guided by educators and practitioners in both K-12 and higher education. Homeplace is seen as an environment where "we could restore ourselves the dignity denied to us on the outside in the public world" (hooks, 1990, p. 42). In other words, to assist in cultivating STEM identity, Black males must be allowed to be themselves.

Black males in STEM

According to NSF (NCSES, 2023), Black students earned 9% of Bachelor's science and engineering degrees in 2020 compared to their White, Asian American, and Hispanic counterparts who earned 58%, 12%, and 17% of these degrees, respectively. Black men account for only 3.8% of these degree earners, yet they account for 7.5% of men age 18–24 and 7.16% of boys under 18. When compared to their White, Asian American, and Latino male counterparts who respectively represent 29.18%, 2.5%, 10.62% of those between the age of 18–24 and 27.61%, 2.2%, and 11.8% of boys under 18 (National Science Foundation, National Center for Science and Engineering Statistics, 2019), the numbers suggest that Black boys and men remain underrepresented in STEM throughout the lifespan.

In the PK-12 education system, Black boys tend to encounter racial and bias practices such as low teacher expectations that serve as a barrier to achievement in mathematics thus creating a barrier to aspirations (Jett & Terry, 2023). Moreover, Black boys often face a deficit-oriented paradigms in school environments that hinder their ability to pursue STEM as well as a mathematic curriculum that is typically not culturally responsive (Fletcher et al., 2023; Jett & Terry, 2023). Additionally, Black males are more likely to face discipinary measures and adultification that can lead to outcomes such as suspension and expulison thus contributing to the lack of academic success that cause low achievement in subjects such as math (Hines et al., 2020). However, strengths-based approach is needed to engage Black males in STEM.

Taking a nuanced look at representation using assets-frames (Harper, 2010; Henderson et al., 2023a), researchers have identified several detractive factors (Morelock, 2017) such as identity interference (e.g., Archer et al., 2014; Collins, 2018; Henderson et al., 2021); an underdeveloped sense of belonging (McGee, 2020; McGee & Martin, 2011); and racialized stressors (Fries-Britt & Kelly, 2005). Also, STEM knowledge is often positioned as objective,

colorblind, and apolitical, yet it has been shown in practice to prioritize White ways of knowing, doing, and being (Baber, 2015; Bang et al., 2012; Barton & Tan, 2010). As a result, students may struggle to see how STEM knowledge and practices relate to their communities and ways of being (Bang et al., 2017; Barton & Tan, 2010; Calabrese Barton et al., 2013).

Despite these challenges, efforts to improve educational outcomes and pathways to careers in STEM fields have grown. For example, interventions have been developed to help overcome disparities at all segments of STEM pathways, such as STEM outreach designed with Black boys in mind (Henderson et al., 2021; Holly, 2020; Wright, 2011); undergraduate research experiences, active learning in the classroom, and living and learning communities (Hossain & Robinson, 2012; Matsui et al., 2003; McGee et al., 2007; Villarejo et al., 2008).

Cultivating STEM identity

Ethnically and racially diverse students oftentimes are not afforded opportunities to access spaces that emphasize their interests and STEM identities, nor have they encountered high school classrooms that value the cultural knowledge, abilities, interests, and experiences they possess that align with STEM curricula (Ortiz et al., 2019). Moroever, these same students continue to be underrepresented in STEM fields, both in industry and in the STEM teaching profession (Ortiz et al., 2019). One of the issues related to their underrepresentation is that they may not perceive their identities to align with STEM fields because of the presently, historically dominant STEM culture, particularly given that these fields are overrepresented with White males (Ortiz et al., 2019). Yet, students' informal and formal pre-college experiences with STEM have been identified by researchers as a contributor to developing learners' STEM identities (Ortiz et al., 2019).

There is evidence that certain school environments and programs (e.g., high school STEM-themed career academies) are more effective at engaging ethnically and racially diverse students, in particular, because of the hands-on nature of the curricula and the increased interpersonal supports of the small learning community (Fletcher & Cox, 2012). From the literature, we know that students' decisions to pursue STEM fields are made at the high school level (Maltese & Tai, 2011). We also know that students who participate in STEM high school programs are significantly more likely to attain STEM occupations in adulthood (Fletcher & Tyson, 2017). It is quite plausible that high school STEM themed career academies have a positive impact on ethnically and racially diverse learners as it relates to developing a positive STEM identity, exposing them to STEM college and career pathways, and promoting their STEM cognitive development.

The development of STEM identity

Identity is a role that students construct during various formal (e.g., within the career academy curriculum) or informal experiences (e.g., internships). Role identity is defined as the meaning a person ascribes within a social and cultural context (Godwin, 2016). Engineering identity, for example, is the notion that students believe that they can indeed perform well in engineering and that the engineering profession is aligned to their personal backgrounds, experiences, and identities (Godwin, 2016). This particular framing is

grounded in social identity theory which posits that a person's self-concept is characteristic of 2 components: personal identity (beliefs about an individual's skill sets, abilities, or attributes) and social identity (their belonging into a social group or groups (Crocker & Luhtanen, 1990; Tajfel, 1981). Social identity theory explains the development and social dynamics of ingroups and outgroups within a setting (Brown, 2000; Crocker & Luhtanen, 1990; Huddy, 2001). Focusing the discussion on STEM fields, there are various ways in which scholars define STEM identity. Dou et al. (2019) defined STEM identity in terms of 2 key elements: STEM interest and STEM recognition. Patrick and Borrego (2016) and Tonso (2006) conceived of engineering identity as having 3 common dimensions of competence, performance, and recognition. However, Hazari and colleagues (2020) framed physics identity as having 4 dimensions: (a) recognition, which is the acknowledgment by others that one is performing well in physics; (b) interest, which is the desire/curiosity to think about and understand physics; (c) performance, which is one's belief in their ability to perform required physics tasks; and (d) competence, which is one's belief in their ability to understand physics content. Further, Hughes et al. (2013) operationalized STEM identity as a construct comprising 3 dimensions: (a) interest in STEM; (b) self-concept as it relates to STEM subject areas; and (c) the impact of role models on students' perceptions of STEM professionals. Even further, Patrick and Borrego (2016) posited that an individual's engineering identity formation must be studied in context with their other social identities (e.g., ethnic/racial background, gender, SES), because engineering identity is formed within the context of these identities. STEM identity formation is widely regarded as a key factor contributing to one's STEM career pursuits (Barton & Tan, 2010; Calabrese Barton et al., 2013; Carlone et al., 2015).

STEM identity formation among ethnically and racially diverse learners

Henderson et al. (2021) argued that there are 3 key mechanisms for forming engineering identity in Black boys: (a) practicing STEM; (b) exposure to STEM role models, and (c) access to STEM mentors. STEM practice is necessary for identity formation because practice is a primary way that a learner can begin to develop a STEM self-concept (Beier & Rittmayer, 2009). This can happen through hands-on activities in a classroom (Beier & Rittmayer, 2009), internship opportunities (Adjapong et al., 2016), afterschool programs (Dou et al., 2019), and service-learning or summer activities (Roberts & Hughes, 2019). Practicing STEM enables students to perform the principles they are learning, and also to gain feedback on their competence in STEM activities. Practice also provides students with a low-stakes opportunity to ascertain whether they want to pursue STEM as a college and/or career option. Henderson et al. (2021) argued that positive STEM role models are vital for STEM identity development because they can help mitigate stereotype threat. Rainey et al. (2018) found that science identity was one of the factors that contributed to a sense of belonging in STEM among ethnically and racially diverse learners, and noted that many underrepresented groups had difficulties engaging in group work with predominantly White males. Matching students of color with similar ethnically and racially diverse STEM role models can improve these students' sense of belonging by enabling them to view role models who represent their cultural interests while helping them navigate the social and cultural ecosystems encountered in STEM environments.

The Meyerhoff Scholars Program (MSP) is an example of an initiative that has positive outcomes of cultivating STEM identity as well as preparing Black students for PhD and MD/PhD programs in STEM. MSP recruits and retains minority students to increase representation in STEM fields through a myriad of programming. The programming includes, a summer bridge program, opportunities to engage in research, study groups, advising and counseling support, study groups, and community engagment with current peers and former MSP scholar (Hrabowki, 2015: Maton et al., 2017; Maton & Hrabowski, 2004). In a study conducted by Maton et al. (2017) found Black individuals who opted into MSP were more likely to enroll in terminal degree programs in STEM than the individuals who decided not to enroll in the program. Moreover, the researchers (Maton et al., 2017) also found that MSP enhanced STEM identity and participants found the programming beneficial.

Social emotional learning, holistic development, and STEM for Black males

The importance of homeplace in developing a STEM identity cannot be overstated. Unfortunately, many school environments are more conducive to harming Black males than to empowering them. As such, efforts to accentuate homeplace are vital for the overall thriving of Black males, and for their development of a STEM identity, in particular. Homeplace describes a place of joyful resistance (hooks, 1990), a place where there is affirmation and healing and a sense of belonging (Mayes & Byrd, 2022). Moreover, homeplace is where critical consciousness can be cultivated and a multidimensional sense of self-efficacy can be realized. This is particularly critical for Black males, whose lived experience is inextricably linked to oppressive and marginalizing conditions. The cultivation of homeplace, then, curates space for their freedom-dreaming and the centering of their brilliance and joy. It is within this safe and empowering context, that a STEM identity can be further developed through the aforementioned pathways and intentional strategies.

Social emotional learning (SEL) can be a key ingredient to adequately promoting a STEM identity in Black males. SEL competencies for the foundation of mental well-being and health, specifically individual skill development and collective empowerment amongst Black males, increase the likelihood of healthy coping patterns being deployed amidst adverse environmental conditions, namely systemic racism. The Collaborative for Academic, Social, and Emotional learning (CASEL) outline 5 competencies, in particular: self-awareness, self-management, social awareness, relationship skills, and responsible decision making. While each competency plays a role, self-awareness and social awareness are particularly crucial. When cultivated appropriately (i.e., through an anti-racist lens, especially) they can also promote thriving. Dysregulated students cannot be sufficiently available for learning, leaving their academic identities and efficacy to suffer. However, SEL through an antiracist lens can create the space needed for Black males to passionately pursue and develop a healthy and positive STEM identity.

Recommendations

Practice

Educators and higher education practitioners can use homeplace to cultivate STEM identity in Black males in several ways.

PK-12 Educators

First, school counselors can use a group counseling approach to work with Black males to discuss the types of STEM careers that exist through career interests and assessment. Hines et al. (2020) discussed preparing Black boys for college readiness through group counseling and the need for school counselors to examine their biases and beliefs about this population. In creating homeplace, school counselors and school psychologists should prioritize personal relationships with Black boys by using counter-storytelling (i.e., critical race theory) to provide homeplace for Black boys. School counselors and school psychologists must affirm Black males and their experiences as well as center their voices within the group counseling process to understand their aspirations and goals. Fletcher et al. (2023) suggested that school leaders and districts recruit more Black male STEM teachers and provide professional development to STEM teachers to ensure that course work is culturally congruent and responsive to the academic learning of Black males.

Higher Education Faculty and Staff

Mentors, peers, and early recruitment and retention programs are crucial to STEM degree attainment and STEM identity development (Henderson et al., 2023a). This further amplifies the effectiveness of exemplary programs such as the Meyerhoff Scholars Program at the University of Maryland Baltimore County (Maton & Hrabowski, 2004) and the federally funded McNair Scholars Program have enhanced the number of Black students who have pursued STEM degrees since the late 1980s. The Meyerhoff approach included a summer bridge program, a sustainable financial aid package, study groups with peer support, personal advising, mentoring, and faculty involvement. Their work revealed that not only did this type of holistic support produce Black male bachelor's degree earners, but also STEM Ph.D. and MD/Ph.D. completers (Maton & Hrabowski, 2004, p. 550). Therefore, we recommend creation or replication of the previously mentioned program.

Policy

When engaging ideas around policy, what has been missing from research conversation to policy implementation are concerted efforts and holistic approaches that strategically and systematically address representation and persistence disparities. For example, given that mentoring is highlighted as a critical component of Black male success in STEM (Henderson et al., 2023b; Slack et al., 2024), college admission policies and hiring practices must be built such that a critical mass of Black males who are available as mentors are recruited at both faculty and student levels (BS, MS, and Ph.D. students). Given the current political climate, institutions will need to have honest policy discussions about how this can be best accomplished by whatever means are appropriate for their institutional context.

Policies at the federal and state levels need to include intentionality in ensuring EVERY individual can see STEM as a viable pathway to a career. Specifically to Black males, states can work with organizations such as My Brother's Keeper, 100 Black men, and Call Me Mister Programs to collaborate on ways to help Black boys and men engage in STEM in ways that they see ooportunities rather than barriers. Moreover, at the school district level, leaders should ensure all schools, specifically underresourced schools provide access to STEM education through qualified teachers to teach science and math and provide rigorous coursework for that is culturally inclusive and responsive (i.e., advanced placement, gifted and

talented, honors courses, and International Baccaluareate programs). At the school level, school personnel (e.g., administrators, school counselors, and teachers) must advocate and provide access to the aforementioned for Black males as well as provide a welcoming into these courses so their brilliance and gifts reach their highest potential.

Research

We must look more deeply into how various factors contribute to students' STEM identity development. There is a dearth of literature regarding the STEM identity development of pre-collegiate students and especially ethnically and racially diverse learners. And, it is important to better understand what is happening prior to college, so that pathways to STEM can be strengthened. Moreover, understanding how NAF (formerly the National Academy Foundation) STEM academies facilitate STEM identity formation among ethnically and racially diverse students will produce findings that inform school stakeholders on best practices for providing equitable educational opportunities for marginalized student groups.

Conclusion

Increasing the representation of Black men and boys in STEM is an American imperative. Educators and higher education practitioners must cultivate environments to ensure Black males can learn and identify with STEM academics and careers in a manner that produces authenticity, joy, and transparency. Developing STEM identities in Black males is a grand challenge that the United States must solve in order to compete in the global workforce.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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Additional resources

1. Hines, E.M., Moore, III, J.L., Cintron, D.W., Singleton, II, P., Golden, M.N., Fletcher Jr., E.C., Henderson, J.A., Slack, T., Moore, W.C., Ouimette, D.T., Reid Jr., M., & Ford, D.Y. (2023). A bridge over troubled water: Designing and implementing a living and learning community to produce optimal outcomes for Black males. *Journal of College and University Student Housing*, *49*(2). 66–85. https://www.nxtbook.com/acuho-i/acuho/journal_vol49no2/index.php#/p/69

Black male retention rates in college tend to be lower than they are for Asians, Whites, and Latino males as well as their gendered counterparts in college. Various factors play a role in the higher attrition rates of Black males in higher education. However, there are programmatic initiatives that can contribute to the academic and career success of these students. For example, living-learning communities are recognized as a high impact practice for student engagement. Moreover, these high impact practices, such as first experiences courses, study abroad, and undergraduate research, contribute to student matriculation and retention. Therefore, this article will detail how the authors contributed to creating the Jamii House, a residential learning community charged with improving the graduation rates of Black males at a research-intensive university in the northeastern United States.

2. Hines, E.M., Fletcher, E.C., Moore III, J.L., & Ford D.Y. (2022). Culturally responsive post-secondary readiness outcomes for Black males: practice and policy recommendations for school counselors. *Journal of School-Based Counseling Policy and Evaluation, 45*(1), 11–25. https://doi.org/10.25774/teyc-zk40

Post-secondary readiness is critical to broadening opportunities for educational and career options beyond high school. However, Black males are often at a disadvantage to gaining access to post-secondary preparation and school counselors who can respond to their academic needs. Therefore, the purpose of this study was to explore the experiences and culturally responsive practices of school stakeholders (who are predominantly Black) from an academy of engineering (career academy). The authors used a case study approach to examine culturally responsive practices school personnel utilize to enhance the college and career readiness of Black males. Findings emphasize the role of culturally responsive practices (e.g., Black male role models from business and industry in the engineering field and school counselors), cultural matching, and the role of the advisory board inensuring the success of Black male students. Recommendations for practice, policy, and research for Black males and school counselors are discussed.

3. Fletcher, E.C., Hines, E.M., Moore III, J.L., & Ford D.Y. (2023). The role of the advisory board in supporting and building more equitable pathways to STEM college and career pathways for Black male students in a high school academy of engineering. *School Science and Mathematics, 123*(3), 125–136. http://doi.org/10.1111/ssm.12578

In this study, we utilized a case study approach to examine the perspectives of 20 school stakeholders regarding equitable ways they promote and broaden the participation of Black male students in a high school academy of engineering (AOE). Madison River Academy (pseudonym) is a comprehensive high school with an AOE embedded in it. The ethnic and racial backgrounds of students at Madison River Academy are 68.8% Black, 14.4% Latinx, 8.7% White, 4.3% Asian, and 3.4% Multiracial. Three themes emerged from our data analyses of the school stakeholder interviews, including the following: (a) a cultural mismatch:denoting the cultural disconnect between teachers and Black male students; (b) math as a gatekeeper: symbolizing mathematics as a barrier Black male participation in the AOE; and (c) promoting equitable access: representing strategies the school stakeholders discussed that could address the equity issues within the AOE. Morespecifically, within the promoting equitable access theme, two subthemes emerged: building vertical pathways from middle to highschool and applying science, technology, engineering, and mathematics(STEM) pathways. We provide recommendations for addressing the equity issues within our case study and promoting higher levels of participation of Black male students in the AO1E.