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A work in progress narrative literature review exploring the impact of minority engineering programs on the experiences of Black students in undergraduate engineering programs

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Introduction

Background

Predominantly White institutions (PWI) have traditionally engaged in the unequal covert treatment of Black students coupled with fallacious visions of change, such as diversity goals and strategic plans that seldom address the institutionalized racism that plagues the experiences of Black students. (Dumas & Ross, 2016; Baber, 2015). The attempt to support Blackness while neglecting the racialized experiences of Black students at the hands of White supremacy is a phenomenon scholars have found to be commonplace among PWIs. As PWIs began establishing themselves as educational and research powerhouses, White male supremacy was the grounding ideology for science, technology, engineering, and mathematics (STEM) education (Slaton, 2010). Scientific racism in the 1800s and 1900s was a product of perceptions and beliefs about the inferiority of Black people (Roberts, 2011). These beliefs permeate all areas of STEM education (Cedillo, 2018), specifically engineering. Stereotypes and racist ideologies have shaped the ideal engineer's appearance, where they come from, and what they can do (McGee & Martin, 2011; Collins, 2018). The journeys of Black students in engineering have been marked by negative interactions and traumatizing experiences at PWIs (McGee & Martin, 2011; McGee, 2016; Ross et al., 2021). These experiences are often characterized by racism, microaggressions, and stereotype threat (McGee & Martin, 2011). An intervention created to address these experiences began in the 1970s: minority engineering programs (Landis, 1991).

History of MEPs

Minority engineering programs (MEPs) were created in response to a growing recognition of the need for diversity and inclusion in engineering education and the workforce. These programs aim to increase the representation of underrepresented minority groups, such as African Americans, Hispanics, Native Americans, and women, in the field of engineering. The creation of minority engineering programs can be attributed to six main themes: (1) the Civil Rights Movement of the 1950s and 1960s, (2) landmark supreme court cases such as 1978 case Regents of the University of California v. Bakke that reaffirmed the legality of affirmative action in college admissions, (3) federal legislations such as Title VI of the Civil Rights Act of 1964 and Title IX of the Education Amendments of 1972, (4) industry partners that developed minority engineering programs in collaboration with universities, (5) advocacy from minority students, faculty, and community organizations that pushed for the creation of these programs, and (6) institutional initiatives that took steps to establish minority engineering programs (Landis, 1991; Slaton, 2012; McNeely & Freehill, 2011).

In the 1970s, MEPs served as community and academic support sources in light of the alarming number of minority students that left the major each year (Landis, 1991). MEPs primarily focus on increasing marginalized students' retention and graduation rates. Some focus on gender marginalization (i.e., women), racially marginalized communities in engineering fields, first-generation students, and students from low-income families. They aim to provide focused resources and intervention to students historically disadvantaged in engineering education in America (Rincon & George-Jackson, 2016; George et al., 2019). They are characterized by affiliation with existing STEM colleges in institutions that majorly serve White students, targeted

recruitment strategies, and focused resources such as tutoring, scholarships, and mentorship (Rincon & George-Jackson, 2016).

Time and time again, MEPs have been cited as a significant contributor to the success of racially marginalized students, specifically Black students (Reichert & Absher, 1997; Tsui, 2007; Flemming, 2016). Still, there is a need to aggregate and examine the current state of literature regarding the study of MEPs and their impact on Black students. This paper will present an introductory narrative literature review regarding how MEPs have served as counter spaces (Solorzano et al., 2000) for Black students at institutions that majorly serve White students. Specifically, this paper seeks to leverage studies that explicitly investigate MEPs to contribute to our understanding of how they can serve as counterspaces for Black students in ST(E)M.

Counter Spaces

Solórzano et al. (2005) identified that Black students create or rely on “counter-spaces” in response to the daily microaggressions they face. They define counterspaces as “sites where deficit notions of people of color can be challenged and where a positive collegiate racial climate can be established and maintained” (p. 70). In their study on the experiences of African-American college students, they found that across the three campuses involved, counterspaces emerged within African-American student groups, entities offering services to African-American and other students, Black fraternities and sororities, peer collectives, and academic study halls organized by Black students.

In STEM, Black students develop physical spaces that challenge racist norms and actions to support their persistence in STEM postsecondary programs (Tichavakunda, 2020, 2021). Counter-spaces can manifest in diverse ways, encompassing abstract concepts like mentor relationships and tangible concepts such as safe havens for minority groups, such as clubs and organizations within STEM departments or institutions. Watkins & McGowan (2022) found that Black communities outside of science and engineering departments served as counterspaces for Black men pursuing degrees at PWIs. While not affiliated with their areas of study, these spaces helped support their unique and often troublesome experiences at their institution. In another study examining Black women's experiences in undergraduate engineering on a primarily White campus, Blosser (2011) suggested that institutional change could begin with supporting and creating counterspaces for Black women and other students with marginalized identities. This institutional change could begin with understanding a possible counterspace that many majority White-serving institutions have, MEPs.

Thomas et al. (2022) found that MEPs serve as a counterspace for Black students by providing them with a space where their racial identity can be empowered. MEPs were found to serve as counterspaces under three categories during their undergraduate journey: professional (supporting professional engineering identity), identity (affirming non-majoritarian identities), and familial (presence of anchoring community) (Thomas et al., 2022). While additional studies explicitly positioning MEPs as counter spaces are limited to the context of Black veterans (Brawner et al., 2022), Black women in STEM (Ashford et al., 2017), and Black men in engineering (Saunders, 2019), the argument can be made that MEPs push back on cultural norms by existing as a space that rejects the stereotypical narrative of what it means to be

Black in engineering. A space like this can lead to elevated levels of agency and positive identity development and facilitate thriving within one's engineering program (Case & Hunter, 2012; Redacted; Thomas et al., 2022). This work-in-progress, narrative literature review aims to define how MEPs implicitly serve as counterspaces for Black students.

Methodology

Narrative Literature Review

Narrative literature reviews are traditionally used to provide a comprehensive summary and analysis of the existing literature on a specific topic (Baumeister & Leary, 1997). Unlike systematic reviews or meta-analyses, which follow a structured methodology and focus on specific research questions, narrative literature reviews offer a more qualitative and interpretative approach (Snyder, 2019). Narrative literature reviews have been widely used in education to synthesize existing research, provide comprehensive overviews, and offer insights into various educational topics. Narrative literature reviews are valuable for gaining insights into the depth and breadth of a research area. They serve as foundational pieces for researchers, helping them understand a particular subject's historical context, critical debates, and significant findings. This work-in-progress, narrative literature review will contribute to our limited understanding of how MEPs serve as counterspaces for Black students in engineering. I aim to provide a comprehensive and critical synthesis of the collected existing literature using specific inclusion criteria that will position Black student experiences as a priority for implementing, evaluating, and considering supporting MEPs.

Paper Selection

To ensure my analysis focused on the unique experiences of Black students relative to how MEPs impacted them, I developed inclusion and exclusion criteria. The criteria for inclusion in this literature review were a publication date from 1970-2023 and the source's relevance to the impact of MEPs on Black students' collegiate experience. A specific decision path can be found in Figure 1. If the program only focused on gender minorities, it was excluded from the papers. If the program focused on racial minorities and gender or other minorities, it was included.

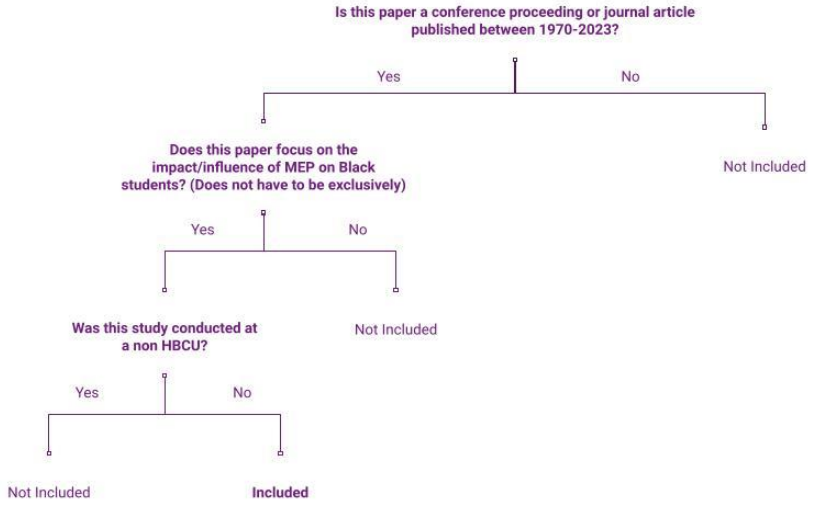

Figure 1: Decision tree for papers included in narrative literature review

Minority student organizations were excluded. While these organizations may assist in achieving the same goals as minority engineering programs, they are not, by definition, a minority engineering program. Thus, they are seldom referred to as such in studies. I focused on papers published from 1970-2023. This wide range of time allows for the totality of papers addressing MEPs and enables me to keep my data collection manageable. I looked specifically at papers published in journals and conferences. I excluded any posters, reports, presentations, or other forms of scholarly dissemination (e.g., dissertations) from my analysis.

Data Collection & Analysis

I used search engines to locate the papers included in this study. I exclusively used Google Scholar as my search engineer to mainstream my search location. Keywords used to search for papers included combinations and variations of the following words: Minority Engineering program, engineering student success/support centers, black student experiences, black students, African American students, predominantly White institution, stem intervention program, and student support program. After identifying the papers based on the inclusion of keywords, I read abstracts to narrow down the scope of each study. If the scope was aligned with the inclusion criteria, the paper was set aside to be included. All papers without open access were retrieved using my university library online access portal to avoid additional fees.

All included papers were read fully and parsed to determine the MEP's impact on the study population. I primarily focused on the findings section to identify said impact. Papers were then separated by categories. The categories included how MEPs impacted Black students. Then, those categories were grouped to identify themes demonstrating how MEPs served as counterspaces. The three emerging themes were redefining the achievement image, valuing Black students' wholistic experiences, and promoting social capital. I intentionally labeled themes with phrases that denoted actions to highlight the active nature of counterspaces.

Findings

From the papers included in the analysis, three main themes emerged: reimagining the image of achievement, valuing Black students' wholistic experiences, and promoting social capital. While these themes do not represent all that MEPs provide to Black students, they were the dominant themes discovered thus far through studies that directly examined the impact of MEPs on Black students. These three themes help to lay the foundation for repositioning MEPs as counterspaces.

Redefining the Image of Achievement

This theme emerged across 100% of the papers included in this analysis. Consistent with the primary mission of MEPs, many studies highlight how programmatic efforts of MEPs provide students with academic enrichment that prepares them for core courses in their engineering majors. In the late 1990s and early 2000s, as many MEPs struggled to maintain legitimacy amidst battles against affirmative action, a multitude of studies emerged to reaffirm the impact of MEPs on the academic achievement of minority students (Lam et al., 1999; Aken et al., 1999; Adair et al., 2001). These studies primarily took an evaluative approach to understanding how MEPs impact Black students. In a study proposing using focus groups to evaluate MEPs, Aken,

Watford, and Medina-Borja (1999) found that students mentioned how academic workshops benefited their academic success. Lam, Doverspike, and Mawasha (1999) identified the significant impacts the MEP had on student GPA and how involvement motivated students to participate in study halls and other academic enrichment. Adair et al. (2001) further identified how students reported high confidence levels after participating in a group learning initiative created by MEP. Good, Halpin, & Halpin (2002) specifically mentioned how, when faced with similar academic challenges, students who participated in the MEP did not consider leaving the major because they felt a strong sense of determination and belief in their ability to succeed. They attributed these feelings to their involvement in the MEP.

This theme has continued to hold beyond that period. Murphey et al. (2011) found significant impacts on graduation rates favoring students who participated in the programmatic offerings of the MEP. Lee & Matusovich (2018) discovered that when students were asked their perceptions of the impact of their MEP on their experiences, many identified that it served as a source of support academically. Shehab, Murphy, and Foor (2012) identified how a previous model of an MEP provided students with academic support that helped them believe that academic achievement was not solely associated with a White racial identity.

These papers identify how MEPs push back on racist beliefs that Black students are incapable of academic excellence. The MEPs studied in these papers provided students with academic support, reaffirming their ability to learn and grasp challenging concepts.

Valuing Black Students' Wholistic Experiences

This theme is characterized by how the MEPs proved safe spaces for Black students. Many Black student perspectives highlighted in the studies included in the analysis identified how they considered the MEP a space where they could be themselves (McCartney et al., 2000; Shehab et al., 2012; Lee & Matusovich, 2018). Specifically, Lee Matusovich (2018) found that students perceived their MEPs to be a source of comfort for students. The participants perceived the MEP space as a semblance of a “home away from home.” They felt that the MEP gave them family.

The same theme was found in Shehab, Murphy, and Foor (2012). The students in the study spoke about how the previous model of the MEP greatly impacted their sense of belonging because they could come to a safe space, share their experiences, and see others who looked like them. This camaraderie was so significant that as the MEP in the study began to shift in structure, it lost what students considered to be the heart of the program, which was a sense of family among individuals who understood each other's experiences. This shift pushed many students of color to no longer consider the MEP a “safe space.”

Although May & Chubin (2003) identified that a focus on academics rather than student support services (i.e., outreach, admissions, advising, counseling) is the best way to remain effective as an MEP, it is essential to note that at the time of this publication, there was a need to prove legitimacy for MEPs and the accepted proof was academic achievement. Nonetheless, the

paper further supported that services such as counseling and advising contributed to the success of minority students whom the MEP served.

The commonality here also aligns with the need for counterspaces to be a refuge for students of color. The MEPs exist as a place to receive counsel, vent, and take a load off, which is critical as many studies have shown that Black students have traditionally negative experiences in engineering programs at PWIs.

Promoting Social Capital

Social capital refers to the collective value that arises from the social networks, relationships, and interactions within a community or society. For students of color, Yosso (2005) defined social capital as the students' “peers and other social contacts” and emphasized how students utilize these contacts to gain college access and navigate their institutions. This theme emerged because it highlighted how MEPs leverage representation and advocacy to help students develop networks among peers, professors, and professionals.

MEPs in the studies included in the analysis identified how MEPs exposed students to key faculty through program events and initiatives (Adair et al., 2001; Good, Halpin & Halpin, 2002; Lee & Matusovich, 2018). Adair et al. (2001) revealed how the MEP strategically exposed students to core faculty through an academic workshop and helped them build relationships with faculty. Students reported positive impacts on professional development and academic success through meaningful relationships established with faculty. Lee & Matusovich (2018) identified how the students perceived MEPs as a source of connection by helping them network among peers, upper-level students, and engineering professionals and meet diverse people. This finding reinforces that Black students are within reach of opportunities through the people around them. The uplifting of peer-to-peer, student-to-mentor (upper-level students), and student-to-professional relationships increases the value of what exists around the student.

Conclusion

Limitation

The findings of this review do not encompass all there is to know regarding the impact of MEPs on Black student experiences in ST(E)M. It is important to note that these findings were extracted from a selective literature group. This analysis only includes some papers ever published about MEPs. Some papers may have been excluded during data collection, or some may have been neglected due to using one search engine. While the findings of this review may span the experiences of many students, it must not be generalized to define the experiences of all Black students. This study illuminates how previous studies prove that MEPs can serve as counterspaces for Black students in ST(E)M. Furthermore, the body of literature fitting the specific inclusion criteria is limited. The findings in the study serve as proof of the need to conduct more studies that look directly at the impact of MEPs on Black student experiences. This literature review presented a harsh reality of the current state of literature regarding MEPs. A limited amount of studies specifically look at the impact of MEPs on student experiences beyond academic efforts for evaluative purposes. Most studies that point out the impact of MEPs on Black students focus primarily on the Black student experience in STEM. From their

experiences, the impact or value of the MEP is mentioned or included as a vital part of the overall journey. (McGee, 2011; Ross, Huff & Godwin, 2021; Damas& Benson, 2021, 2022; Thomas et al., 2022).

Future Work

Moving forward, I will continue to identify literature that meets the inclusion criteria to develop a more wholistic view of the current state of literature. I aim to identify more emergent themes that can increase our understanding of how MEPs serve as counterspaces. I plan to expand my research engine beyond Google Scholar to increase the number of papers included. The expansion will enable me to have access to even more publications. I will also modify my inclusion criteria to include other forms of scholarly dissemination, such as dissertations, reports and book chapters. I plan to develop an analysis that accurately depicts the current state of the literature regarding the direct study of the impact of MEPs.

Nevertheless, more intentional work is needed to directly investigate MEPs and their impact on students of color. It is also essential to have demographic differentiation because it supports the understanding that not all minority demographic groups have the same experiences. More tailored work is needed to provide a complete picture of the extent of impact that MEPs have on the communities they serve. Furthermore, more studies in this area will allow students of color to speak on how the MEP influenced their road to success. Emerging literature could highlight positive experiences in the context of MEPs, further supporting the need for MEPs in universities that mainly serve White students.

References

Adair, J. K., Reyes, M. A., Anderson-Rowland, M. R., & Kouris, D. A. (2001, October). Workshops vs. tutoring: How ASU's minority engineering program is changing the way engineering students learn. In 31st Annual Frontiers in Education Conference. Impact on Engineering and Science Education. Conference Proceedings (Cat. No. 01CH37193) (Vol. 2, pp. T4G-7). IEEE.

Aken, E. M. V., Watford, B., & Medina‐Borja, A. (1999). The use of focus groups for minority engineering program assessment. Journal of Engineering Education, 88(3), 333-343.

Ashford, S. N., Wilson, J. A., King, N. S., & Nyachae, T. M. (2017). STEM SISTA spaces. Emerging issues and trends in education, 3.

Blosser, E. (2020). An examination of Black women's experiences in undergraduate engineering on a primarily white campus: Considering institutional strategies for change. Journal of Engineering Education, 109(1), 52–71.

Brawner, C., Mobley, C., Lord, S. M., & Main, J. Fit, Faith, and Family: Counterspaces for Black Male Student Veterans in Engineering. Journal of Women and Minorities in Science and Engineering.

Case, A. D., & Hunter, C. D. (2012). Counterspaces: A unit of analysis for understanding the role of settings in marginalized individuals' adaptive responses to oppression. American journal of community psychology, 50, 257-270.

Damas, S. A., & Benson, L. C. (2021, October). Navigational capital of African American students in engineering at a predominantly white institution. In *2021 IEEE Frontiers in Education Conference (FIE)* (pp. 1-5). IEEE.

Damas, S. A., & Benson, L. (2022, February). Lived Experiences of African American Engineering Students at a PWI Through the Lens of Navigational Capital. In *2022 CoNECD (Collaborative Network for Engineering & Computing Diversity)*.

Fleming, J. (2016, June). Success Factors for Minorities in Engineering: Analysis of Focus Group Mini-Surveys. In *2016 ASEE Annual Conference & Exposition*.

George, C. E., Castro, E. L., & Rincon, B. (2019). Investigating the origins of STEM intervention programs: An isomorphic analysis. Studies in Higher Education, 44(9), 1645-1661.

Good, J., Halpin, G., & Halpin, G. (2002). Retaining Black students in engineering: Do minority programs have a longitudinal impact?. *Journal of College Student Retention: Research, Theory & Practice*, *3*(4), 351-364.

Lam, P. C., Doverspike, D., & Mawasha, R. P. (1999). Predicting success in a minority engineering program. Journal of Engineering Education, 88(3), 265-267.

Lee, W. C., & Matusovich, H. M. (2018). Investigating how undergraduate students perceive co-curricular support in engineering. Journal of Women and Minorities in Science and Engineering, 24(3).

May, G. S., & Chubin, D. E. (2003). A retrospective on undergraduate engineering success for underrepresented minority students. Journal of engineering education, 92(1), 27-39.

McCartney, M. A., & Reyes, M. A., & Anderson-Rowland, M. (2000, June), *Learning From Our Minority Engineering Students: Improving Retention* Paper presented at 2000 Annual Conferenc St. Louis, Missouri. 10.18260/1-2--8536

McGee, E. O., & Martin, D. B. (2011). "You would not believe what I have to go through to prove my intellectual value!" Stereotype management among academically successful Black mathematics and engineering students. American Educational Research Journal, 48(6), 1347-1389.

McNeely, C. L., & Frehill, L. M. (2011). Assessing US minority engineering programs: outline of a research agenda. GMU School of Public Policy Research Paper, (2011-25).

Murphy, T. E., Gaughan, M., Hume, R., & Moore Jr, S. G. (2010). College graduation rates for minority students in a selective technical university: Will participation in a summer bridge program contribute to success?. *Educational evaluation and policy analysis*, *32*(1), 70-83.

Reichert, M., & Absher, M. (1997). Taking another look at educating African American engineers: The importance of undergraduate retention. *Journal of Engineering Education*, *86*(3), 241-253.

Rincon, B. E., & George-Jackson, C. E. (2016). STEM intervention programs: funding practices and challenges. Studies in Higher Education, 41(3), 429-444.

Ross, M. S., Huff, J. L., & Godwin, A. (2021). Resilient engineering identity development critical to prolonged engagement of Black women in engineering. Journal of Engineering Education, 110(1), 92-113.

Saunders, S. M. (2019). BROTHERHOOD: An Assessment of the Experiences of Black and Latino Male Engineers at the University of Pittsburgh Swanson School of Engineering (Doctoral dissertation, University of Pittsburgh).

Shehab, R., Murphy, T. J., & Foor, C. E. (2012). " do they Even have that Anymore": the Impact of Redesigning a Minority Engineering Program. Journal of Women and Minorities in Science and Engineering, 18(3).

Slaton, A. E. (2010). Race, rigor, and selectivity in US engineering: The history of an occupational color line. Harvard University Press.

Solorzano, D., Ceja, M., & Yosso, T. (2000). Critical race theory, racial microaggressions, and campus racial climate: The experiences of African American college students. Journal of Negro Education, 69(1/2), 60-73.

Thomas, K., Coley, B. C., Greene, M. L., & London, J. S. (2021). Black faces, White spaces: Understanding the role of counterspaces in the Black engineering graduate student experience. 2021 CoNECD.

Tichavakunda, A. A. (2020). Studying Black student life on campus: Toward a theory of Black placemaking in higher education. *Urban Education*, 0042085920971354.

Tichavakunda, A. A. (2021). *Black campus life: The worlds Black students make at a historically White institution*. State University of New York Press.

Tsui, L. (2007). Effective strategies to increase diversity in STEM fields: A review of the research literature. *The Journal of Negro Education*, 555-581.

Yosso*, T. J. (2005). Whose culture has capital? A critical race theory discussion of community cultural wealth. *Race ethnicity and education*, *8*(1), 69-91.