

Black Women's Lived Experiences in STEM Education and Professional Spaces: Barriers, Identity, and Institutional Challenges

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Article Info	Abstract
<p>Keywords</p> <p>Black Women , STEM Education, Intersectionality, Gender, Race, Institutional Inclusion</p>	<p>This paper examines the structural, organizational, and interpersonal Barriers shaping the experiences of Black women in STEM education and professional environments, with particular attention on isolation, microaggressions, harassment, and the intersecting dynamics of racism and sexism. Grounded in Black Feminist Theory and intersectionality, the study analyzes how institutional cultures, peer relations, and mentoring structures and organization practices contribute to the persistent marginalization of Black women within STEM spaces. Despite ongoing diversity initiatives and increased enrollment of students from varied racial backgrounds, Black women remain significantly underrepresented and disproportionately disadvantaged in STEM education and careers.</p> <p>Methodologically, the study adopts a secondary mixedmethods approach, synthesizing qualitative narratives drawn from peerreviewed studies, institutional reports, and published interviews, alongside quantitative data from national and international surveys on gendered and racial disparities in STEM participation and retention. The findings reveal that marginalization is not incidental but structurally embedded within educational and professional systems, while persistence is often sustained through emotional labor, informal support networks, and individual resilience rather than formal institutional inclusion mechanisms. By foregrounding Black women's lived experiences, the study challenges deficitbased explanations and highlights the need for systemic organizational and policylevel interventions. The paper argues that fostering inclusive STEM environments requires rethinking diversity management, mentorship models, and institutional accountability to address intersectional inequalities and promote sustainable participation of marginalized groups in STEM education and professions.</p>

Introduction

Black women remain among the most underrepresented and marginalized groups within science, technology, engineering, and mathematics (STEM) education and professional fields, despite sustained institutional efforts aimed at increasing diversity and access. While policy interventions often emphasize numerical representation and participation, they frequently fail to address the intersectional nature of inequality that structures Black women's educational and professional trajectories. Their experiences in STEM are not defined solely by underrepresentation but are shaped by persistent encounters with racialized sexism, institutional exclusion, and unequal organizational practices. As a result, Black women often navigate STEM environments characterized by isolation, microaggressions, and structural inequities, even while demonstrating high levels of academic persistence and professional competence.

Existing scholarship identifies multiple, intersecting barriers faced by Black women in STEM, including limited access to mentorship, implicit bias in evaluation, gendered racial stereotypes, and heightened scrutiny of competence. Within many institutional contexts, these challenges are normalized through discourses of meritocracy and objectivity, which obscure underlying power relations and limit critical engagement with systemic inequality.

Consequently, experiences of exclusion are frequently individualized, framing structural failures as personal shortcomings rather than organizational or cultural issues.

Intersectionality, as articulated by Kimberlé Crenshaw, provides a crucial analytical framework for understanding how race and gender interact within educational and professional institutions to produce distinct and compounded forms of marginalization.

In parallel, Black feminist epistemology foregrounds lived experience, relational knowledge, and collective resistance as legitimate sources of knowledge production. Drawing on this perspective, the present study argues that the continued participation of Black women in STEM should not be understood through deficit-based narratives of attrition or remediation. Instead, their persistence reflects adaptive strategies of survival and negotiation, including reliance on family and community support, peer networks, cultural affirmation, and self-definition. These strategies challenge dominant STEM cultures that often devalue emotional labor, relational learning, and culturally grounded forms of knowledge.

Responding to growing calls within STEM education and workforce research to center marginalized voices beyond symbolic diversity initiatives, this study adopts an intersectional mixed-methods approach. It combines qualitative analysis of interviews with Black women

STEM students and professionals with secondary quantitative analysis of national survey data to examine experiences of systemic barriers, institutional practices, and modes of resistance. By situating Black women's STEM experiences within broader frameworks of organizational culture, gender equity, and social sustainability, the paper contributes to interdisciplinary discussions in social work, management studies, and education.

Ultimately, the study reframes Black women in STEM not as exceptions within exclusionary systems, but as critical agents of knowledge creation and institutional transformation. By integrating intersectionality and Black feminist thought, the paper offers actionable insights for educators, administrators, and policymakers seeking to build more equitable, inclusive, and sustainable STEM environments.

Methodology

Research Design

This study adopts a secondary mixedmethods research design to examine the structural marginalization, resilience, and persistence of Black women in STEM education and professional spaces. The use of secondary data is particularly appropriate for research on historically underrepresented populations, as it allows for the ethical integration of largescale quantitative datasets with rich qualitative accounts that are already documented in peerreviewed scholarship, institutional reports, and publicly available narratives.

The study follows an integrative mixedmethods approach, in which qualitative and quantitative data are first analyzed independently and subsequently interpreted in relation to one another to generate a holistic understanding of Black women's lived experiences in STEM. This approach aligns with social work and management research standards that emphasize methodological transparency, analytical triangulation, and theoretical grounding, rather than reliance on primary data alone. By synthesizing multiple forms of secondary evidence, the study strengthens the validity and reliability of its findings while addressing systemic patterns of inequality in educational and professional institutions.

Theoretical and Analytical Framework

The analysis is grounded in Black Feminist Thought (Collins, 2000) and Intersectionality Theory (Crenshaw, 1991), which recognize lived experience as a legitimate form of

knowledge and highlight the interdependence of race, gender, and institutional power. These frameworks justify the use of secondary qualitative narratives, published interviews, autobiographical accounts, and ethnographic studies as credible empirical sources rather than anecdotal evidence.

In addition, the study draws upon critical scholarship in STEM education and organizational studies, which challenges the assumption of scientific and professional institutions as neutral spaces. This body of literature demonstrates how exclusion is reproduced through organizational culture, pedagogical norms, leadership hierarchies, and informal power structures. Together, these frameworks enable an analysis of STEM environments as social institutions shaped by structural inequality, making the study relevant to MSW, management, and human capital research.

Data Sources

Qualitative Secondary Data

The qualitative component of the study draws on existing scholarly and institutional literature, including peerreviewed journal articles that document interviews with Black women STEM students and professionals (e.g., Morton & Parsons, 2018, BlackGirlMagic), national reports addressing experiences of racism, sexism, and professional isolation, and selected autobiographical essays and interviews by Black women intellectuals and activists. Reports published by advocacy organizations such as the American Association of University Women (AAUW), Black Girls Code, and STEM Women of Color are also included.

Only sources published between 2000 and 2024 are considered in order to ensure contemporary relevance. Academic databases including Scopus, JSTOR, Web of Science, ERIC, and Google Scholar were systematically used to identify and access relevant materials.

Quantitative Secondary Data

The quantitative component relies on largescale, publicly available datasets from nationally and internationally recognized institutions. These include data from the National Science Foundation (NSF), the National Survey of Student Engagement (NSSE), AAUW STEM equity surveys, reports from the Pew Research Center, and genderinSTEM datasets published by OECD and UNESCO. These sources provide statistical insights into patterns of enrollment, retention, attrition, access to mentorship, and the impact of discrimination and harassment on Black women in STEM education and professional environments.

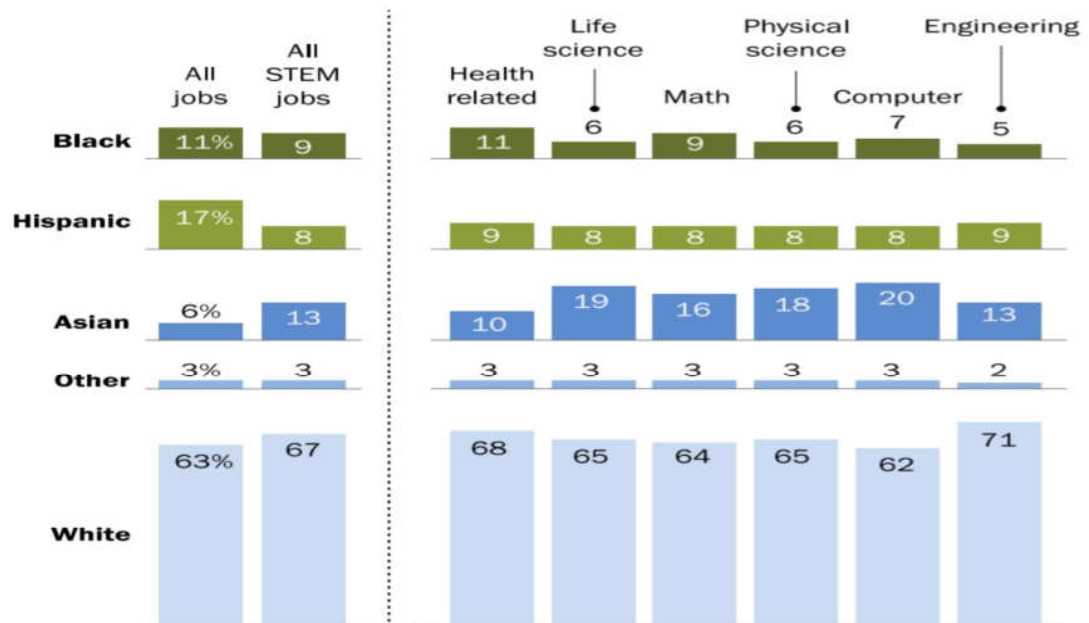
Analysis

Structural Underrepresentation and Attrition in STEM

Data from the Pew Research Center and the National Science Foundation (NSF) provide clear evidence of persistent racial and gender disparities across STEM education and employment. Educational institutions function as critical gatekeeping sites where inequities emerge well before individuals enter the professional workforce. Limited access to advanced science coursework, research-oriented learning environments, and institutional mentoring reduces early academic confidence and preparedness among Black women, thereby narrowing entry into competitive STEM majors and careers. These educational inequalities subsequently translate into reduced representation across professional STEM sectors.

Black and Hispanic workers remain underrepresented in the STEM workforce

% who are...



Notes: Based on employed adults ages 25 and older. STEM stands for science, technology, engineering and math occupations. Engineering includes architects. White, Black and Asian adults include those who report being only one race and are not Hispanic. Hispanics are of any race. Other includes non-Hispanic American Indian or Alaskan native, non-Hispanic Native Hawaiian or Pacific Islander and non-Hispanic two or more major racial groups. Source: Pew Research Center analysis of 2017-19 American Community Survey (IPUMS) "STEM Jobs See Uneven Progress in Increasing Gender, Racial and Ethnic Diversity"

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Table 1. Representation of Women and Minorities in STEM Fields

Source: Adapted from Pew Research Center (2021) and NSF (2022).

As shown in Table 1, despite overall increases in women’s participation in higher education, racialized disparities within STEM persist. Nationallevel quantitative data indicate that Black women remain disproportionately underrepresented among STEM degree recipients and professionals relative to their share of the population. This underrepresentation is particularly

pronounced in engineering, computer science, and physical sciences—fields where racial and gender exclusions intersect most strongly.

While aggregate data reflect modest gains for women overall, these gains have disproportionately benefited white and Asian women. In contrast, Black women continue to face structural marginalization across STEM disciplines. These patterns support an intersectional interpretation: genderfocused inclusion initiatives that fail to address racialized barriers risk reproducing inequality under the guise of progress. The findings further suggest that underrepresentation is not merely a pipeline issue but a consequence of structural constraints operating throughout educational and professional trajectories.

When examined alongside qualitative evidence, numerical underrepresentation functions not only as an outcome but also as an indicator of exclusionary academic cultures, limited access to mentorship, and uneven institutional support. Multiple secondary datasets confirm that Black women remain significantly underrepresented in both STEM education and the workforce.

NSF reports consistently show lower enrollment and completion rates for Black women in engineering, computer science, and physical sciences compared to white women and Black men. These disparities persist at advanced degree levels, indicating patterns of systematic attrition rather than individual disengagement or lack of capability. Qualitative scholarship attributes attrition primarily to inhospitable academic environments rather than personal failure. From an intersectional perspective, underrepresentation reflects the cumulative effects of exclusionary practices embedded within STEM institutions.

Isolation and Sense of NonBelonging

Qualitative studies consistently identify isolation as a defining feature of Black women's experiences in STEM. Participants frequently report being the only Black woman in classrooms, laboratories, or research groups. Carlone and Johnson (2007), in their interviewbased study of successful women of color in science, conceptualize science identity through three interrelated dimensions: competence, performance, and recognition. While participants demonstrated high competence and strong scientific performance, recognition from peers, faculty, and institutions remained uneven and conditional.

Their findings indicate that women of color often achieve academic success without receiving corresponding institutional validation. This lack of recognition contributes to identity strain and reinforces isolation, underscoring that marginalization in STEM is structurally produced rather than individually determined. Isolation operates not only socially but epistemically, as Black women frequently report that their perspectives, knowledge contributions, and intellectual labor are undervalued within dominant STEM cultures. Intersectionality theory explains how the combined effects of race and gender intensify invisibility, reinforcing alienation and negatively affecting academic engagement and professional integration.

Microaggressions, Harassment, and Institutional Silence

Secondary qualitative literature documents recurring experiences of microaggressions, racialized sexism, and gendered racism in STEM environments. These include assumptions of intellectual inferiority, exclusion from collaborative work, and dismissal of concerns.

Quantitative surveys from the Pew Research Center further demonstrate that women of color in STEM report higher levels of workplace discrimination compared to white women.

Institutional responses to these experiences are frequently minimal or dismissive, exacerbating their impact. Organizational silence normalizes microoppression, contributing to psychological exhaustion and reinforcing structural barriers to persistence. From a management and social work perspective, these patterns reflect systemic failures in accountability, grievance mechanisms, and inclusive organizational culture.

Family, Community, and Cultural Capital as Survival Resources

Despite systemic barriers, Black women persist in STEM through reliance on family support, community networks, and culturally grounded forms of resilience. Morton and Parsons (2018) examine how Black undergraduate women in STEM construct identity within racialized and gendered academic spaces, introducing the concept of BlackGirlMagic to describe strategies of affirmation, resistance, and collective identity formation. These cultural resources enable persistence in environments that often lack formal institutional support.

Such identity work functions as a survival strategy within exclusionary academic systems, emphasizing that persistence is sustained through cultural capital rather than organizational inclusion. These findings reinforce the argument that while underrepresentation is structurally produced, endurance within STEM is disproportionately supported by informal and communitybased mechanisms rather than institutional responsibility.

Persistence as Resistance

Persistence among Black women in STEM emerges not as passive endurance but as an active form of resistance to institutional exclusion. Continued participation disrupts dominant narratives that frame merit and neutrality as apolitical, revealing instead the racialized and gendered conditions under which scientific legitimacy is constructed. Reframing persistence as resistance shifts analytical responsibility away from individuals and toward institutions, highlighting the need for structural accountability.

Table 2: Race and National Origin for Women in STEM

Race/National Origin	Women	Men	Total	% Women
African American/Black	14,066	19,256	33,322	42.2%
American Indian/Alaska Native	932	1,856	2,788	33.4%
Asian	9,423	19,926	29,349	32.1%
Hawaiian/Pacific Islander	268	697	965	27.8%
White	63,710	169,030	232,740	27.4%
More than one race	1,910	3,956	5,866	32.6%
Hispanic/Latinx	6,198	14,139	20,337	30.5%
Total	96,507	228,860	325,367	29.7%

Table 2. Racial Distribution of Women in Federal STEM Workforce

Source: Adapted from EEOC (2022)

Table 2 illustrates the persistence of intersectional inequality beyond education and into federal STEM employment. Although women occupy a visible share of federal STEM positions, racial disaggregation reveals that Black women remain significantly underrepresented relative to white women (NSF, 2023). This disparity is particularly notable given formal diversity and equity commitments within the federal sector.

Furthermore, Black women are disproportionately concentrated in lower level positions and remain underrepresented in leadership and decision making roles. This pattern reflects what Black feminist scholars describe as institutional containment, wherein access is nominal while advancement is structurally constrained. These findings underscore the limitations of numerical diversity absent cultural transformation and accountability mechanisms, reinforcing the need for organizational change beyond policy-level inclusion.

Methods

To examine the continued marginalization and limited advancement of Black women in STEM education, this study employs a secondary mixed methods research design. Both qualitative and quantitative data were drawn from peer-reviewed literature, institutional reports, and nationally recognized surveys. A secondary research approach is particularly appropriate for analyzing systemic inequities, as it enables large-scale pattern analysis while centering lived experiences documented across diverse institutional and social contexts.

Qualitative data were obtained from published interview-based studies, ethnographic research, and narrative accounts that examine Black women's experiences in STEM classrooms, laboratories, and academic cultures. Relevant sources were identified through academic databases using keywords such as Black women in STEM, intersectionality, microaggressions, harassment, and sense of belonging. Only empirically grounded studies published between 2000 and 2024 were included to ensure contemporary relevance.

Quantitative data were sourced from national and international reports issued by the National Science Foundation (NSF), the American Association of University Women (AAUW), the Pew Research Center, and UNESCO. These datasets provide statistical information on

enrollment, retention, campus climate, and self-reported discrimination experienced by Black women in STEM.

Qualitative materials were analyzed using thematic synthesis, while quantitative findings were examined through descriptive synthesis. Integration occurred at the interpretive stage, where structural trends were analyzed alongside experiential narratives through an intersectional Black feminist analytical lens.

Results

The findings reveal consistent patterns of structural marginalization affecting Black women in STEM across educational and professional contexts. Quantitative data indicate persistent under-representation, elevated attrition rates, and exposure to hostile academic environments. National surveys report significantly lower levels of belonging and higher levels of perceived bias among Black women compared to both white women and Black men in STEM fields.

Qualitative findings deepen this interpretation by illustrating how marginalization is experienced and internalized. Across studies, Black women report isolation in classrooms and laboratories, frequent microaggressions, racialized sexism, and sustained pressure to prove intellectual legitimacy. Harassment—both overt and covert—is frequently described as normalized and institutionally unchecked, contributing to psychological exhaustion and academic or professional withdrawal.

Despite these barriers, the data also demonstrate notable patterns of persistence and resistance. Family support, cultural affirmation, spiritual grounding, and community accountability emerge as critical sources of resilience. Many participants frame their continuation in STEM not only as personal achievement but as a collective responsibility.

Mentorship appears as a decisive factor influencing retention. The absence of mentorship intensifies alienation, whereas even informal mentoring relationships significantly enhance persistence. Overall, the results indicate that the under-representation of Black women in STEM is not attributable to lack of ability or interest, but to intersecting systems of racialized and gendered marginalization.

Discussion

The findings underscore the necessity of interpreting Black women's experiences in STEM through an intersectional framework. Attrition cannot be adequately explained through quantitative disparities alone without accounting for the cumulative effects of everyday micro-oppressions documented in qualitative narratives. Together, the data demonstrate that STEM education functions as an institutional space in which racial and gender hierarchies are reproduced under the guise of meritocracy and objectivity.

Black feminist theory enables the reconceptualization of persistence not as an individual attribute but as a form of structural resistance. STEM cultures have historically privileged norms of whiteness, masculinity, and presumed neutrality, systematically marginalizing those who do not conform. From this perspective, Black women's continued participation in STEM cannot be understood solely through narratives of personal perseverance; rather, it reflects sustained resistance to institutional exclusion.

The study also highlights isolation as a powerful exclusionary mechanism. Being one of few—or the only—Black woman in STEM spaces intensifies surveillance, tokenism, and emotional labor. When accumulated, microaggressions function as institutional barriers rather than isolated incidents.

By synthesizing secondary qualitative and quantitative data, this study contributes to STEM education and management scholarship by illustrating how marginality is constructed, experienced, and contested. It calls for pedagogical and institutional frameworks that recognize Black women as knowledge producers rather than exceptions.

Conclusion

This study demonstrates that the marginalization of Black women in STEM education and professions is not the result of individual limitations, but of structural, cultural, and institutional forces embedded within academic and professional hierarchies. Through a secondary mixed-methods analysis, the findings reveal how racism, sexism, isolation, microaggressions, and harassment collectively shape educational trajectories and professional outcomes.

At the same time, the study highlights persistence as a form of intellectual survival and resistance. Family support, cultural grounding, and community responsibility emerge as essential counter-forces to exclusion, challenging deficit-based explanations of under-representation.

By integrating lived experience with statistical evidence, this research affirms the methodological and theoretical significance of intersectionality in STEM studies. It further demonstrates the value of secondary mixed-methods approaches in equity-focused research. Ultimately, achieving equity in STEM requires more than access; it necessitates cultural, pedagogical, and structural transformation. Recognizing the knowledge, creativity, and resilience of Black women is not an addition to STEM reform—it is fundamental to its sustainability and ethical responsibility.

Recommendations

Based on the findings, the study offers the following recommendations:

First, STEM institutions must move beyond representational diversity and address campus climate, accountability mechanisms, and transparent reporting systems for harassment and discrimination. Anti-racism and gender equity training should be continuous, enforceable, and institutionally embedded rather than symbolic.

Second, mentorship structures should be institutionalized, particularly for Black women and other marginalized groups. Access to culturally responsive mentorship significantly enhances retention and belonging. Mentorship must be recognized as academic labor and formally rewarded by institutions.

Third, STEM curricula should integrate culturally sustaining pedagogies, including narrative-based learning, community-engaged projects, and interdisciplinary approaches that legitimize diverse epistemologies and counter academic alienation.

Fourth, data collection practices must consistently disaggregate race and gender to prevent the erasure of Black women's experiences within broader diversity categories.

Finally, policymakers and funding agencies should prioritize investment in institutions and initiatives with demonstrated effectiveness in supporting Black women in STEM.

These recommendations emphasize systemic responsibility, positioning equity not as corrective intervention but as institutional transformation.

References

- American Association of University Women. (2020). *The STEM gap: Women and girls in science, technology, engineering, and math*. AAUW.
- Carlone, H. B., & Johnson, A. (2007). *Understanding the science experiences of successful women of color: Science identity as an analytic lens*. *Journal of Research in Science Teaching*, 44(8), 1187–1218.
- Collins, P. H. (2000). *Black feminist thought: Knowledge, consciousness, and the politics of empowerment* (2nd ed.). Routledge.
- Crenshaw, K. (1991). Mapping the margins: Intersectionality, identity politics, and violence against women of color. *Stanford Law Review*, 43(6), 1241–1299.

- LadsonBillings, G. (1995). Toward a theory of culturally relevant pedagogy. *American Educational Research Journal*, 32(3), 465–491. <https://doi.org/10.3102/00028312032003465>
- Morton, T. R. and Parsons, E. C. (2018). *BlackGirlMagic: The identity conceptualization of Black women in undergraduate STEM education*. *Science Education*, 102(6), 13631393. <https://doi.org/10.1002/sce.21477>
- National Research Council. (2011). *Successful K12 STEM education: Identifying effective approaches in science, technology, engineering, and mathematics*. The National Academies Press. <https://doi.org/10.17226/13158>
- National Science Foundation. (2023). *Women, minorities, and persons with disabilities in science and engineering*. NSF.
- Pew Research Center. (2018). *Women and men in STEM often at odds over workplace equity*. Pew.
- Pew Research Center. (2021). *STEM jobs see uneven progress in increasing gender, racial and ethnic diversity*. Pew Research Center. <https://www.pewresearch.org/science/2021/04/01/stemjobsseeunevenprogressinincreasinggenderandethnicdiversity/>
- Sleeter, C. E. (2017). *Critical family and community studies in education*. Routledge.
- Tate, W. F. (2013). *Urban education and the challenge of structural inequality*. Teachers College Press.
- UNESCO. (2017). *Cracking the code: Girls' and women's education in STEM*. UNESCO.
- U.S. Equal Employment Opportunity Commission. (2022). *Special topic report: Women in STEM occupations in the federal workforce*. EEOC. <https://www.eeoc.gov/specialtopicsannualreportwomenstem>

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