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The Hidden Burden: Impostor Syndrome Among Women of Color in STEM Education

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ABSTRACT

Impostor syndrome presents a persistent barrier to belonging, confidence, and persistence among women of color in STEM education. While commonly framed as an individual psychological struggle, impostor feelings are shaped by intersecting racial and gender identities and reinforced by institutional climates marked by underrepresentation, microaggressions, and exclusionary practices. This conceptual review synthesizes recent scholarship to examine how structural inequities within STEM environments contribute to chronic self-doubt, emotional strain, and constrained academic and career pathways. Guided by intersectionality and critical consciousness, the review reframes impostor syndrome as a systemic and educational issue rather than a personal deficit. The analysis highlights documented psychological and educational consequences and identifies institutional leverage points, including culturally responsive mentorship and identity-affirming practices, to promote equity and persistence for women of color in STEM.

Keywords: Belonging; equity; impostor syndrome; intersectionality; STEM education; women of color

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INTRODUCTION

Impostor syndrome remains a significant barrier to confidence, persistence, and academic achievement among women of color pursuing STEM education. First identified by Clance and Imes (1978), impostor syndrome describes persistent feelings of intellectual fraudulence experienced by capable individuals despite objective indicators of success. Although impostor experiences occur across disciplines, research consistently demonstrates that they are particularly prevalent among women of color in Science, Technology, Engineering, and Mathematics (STEM) fields, where racialized and gendered underrepresentation shapes experiences of belonging, evaluation, and recognition (Bravata et al., 2020). Women of color in STEM often navigate academic environments characterized by limited representation, heightened scrutiny, and exposure to racialized and gendered stereotypes, conditions that contribute to experiences of "onlyness," in which individuals perceive themselves as the sole representative of their social identity within classrooms, laboratories, or academic programs (Perkins & Durkee, 2025). Such contexts intensify psychological stress and reinforce impostor feelings, undermining confidence and persistence over time (Joshi et al., 2025).

When examined within the context of structural inequities and intersectional identity pressures, impostor syndrome emerges not solely as an individual psychological experience but as a reflection of systemic and institutional conditions that shape belonging, persistence, and achievement in STEM education. Framing impostor syndrome in this way underscores the need for scholarly and institutional attention to the broader educational environments in which these experiences occur. While existing scholarship has examined impostor syndrome across a range of populations, the literature remains fragmented with respect to how intersecting identities and institutional conditions shape impostor experiences for women of color in STEM education. Much of the research addresses

impostorism as an individual psychological phenomenon, with less attention to the structural, pedagogical, and cultural contexts that sustain these experiences.

This article presents a conceptual review of recent literature on impostor syndrome among women of color in STEM education. Drawing on intersectionality and critical consciousness as organizing lenses, the review synthesizes empirical and theoretical scholarship to identify key patterns, consequences, and gaps in the literature. By situating impostor syndrome within STEM pedagogical and institutional contexts, this review contributes to a clearer understanding of how educational environments shape impostor experiences and highlights implications for research, teaching, and institutional practice.

PURPOSE

Although research on impostor syndrome has expanded across disciplines, prior scholarship has not sufficiently synthesized how intersecting identities and institutional conditions jointly shape impostor experiences among women of color in STEM education, nor has it clearly articulated the implications for STEM pedagogy and institutional practice. The purpose of this conceptual review is to synthesize recent scholarship on impostor syndrome among women of color in STEM education and to clarify how intersecting racial and gender identities, institutional climates, and educational practices shape these experiences.

Drawing on empirical and theoretical literature, this review examines how structural inequities, including underrepresentation in faculty and leadership roles, exposure to racialized and gendered microaggressions, and limited access to mentoring and professional networks, contribute to sustained patterns of self-doubt, emotional labor, and diminished belonging among women of color in STEM environments (Ong et al., 2017). Rather than proposing new interventions, this review seeks to clarify patterns across the literature and highlight institutional conditions that either exacerbate or mitigate impostor experiences in STEM education. To anchor the review and guide analysis, this article addresses the following research questions:

Q1. How does the existing literature characterize the experiences of impostor syndrome among women of color in STEM education, particularly in relation to intersecting racial and gender identities?
Q2. What structural and institutional factors within STEM educational environments contribute to the emergence and persistence of impostor syndrome among women of color, including underrepresentation, microaggressions, and institutional climate?
Q3. What gaps remain in the current literature, and what directions are recommended for future research, pedagogy, and institutional practice aimed at fostering equity, belonging, and persistence in STEM education?

Despite a growing body of research on impostor syndrome, significant gaps remain in understanding how intersecting identities and institutional contexts shape impostor experiences among women of color in STEM. Much of the existing literature relies on generalized populations, resulting in frameworks and interventions that inadequately capture the unique realities of underrepresented groups (Rohrmann et al., 2016). Additionally, the predominance of quantitative approaches often limits insight into the lived experiences of women of color, underscoring the need for more intersectional, qualitative, and mixed-method research that centers identity, context, and institutional power (Simon, 2021; Thompson & Kerr, 2023).

By addressing these questions, this conceptual review deepens understanding of the unique psychological burden that women of color experience in STEM environments, clarifies the systemic and educational conditions that sustain impostor syndrome, and highlights evidence-informed opportunities for promoting equity, belonging, and inclusive practice within STEM education.

SIGNIFICANCE

Understanding the intersectional nature of impostor syndrome among women of color in STEM is essential for advancing conversations about equity, belonging, and mental well-being in educational contexts. The emotional and psychological consequences of impostorism, ranging from anxiety and perfectionism to exhaustion and burnout, can have long-term effects on persistence, career advancement, and self-efficacy (Mann et al., 2023). Without intentional institutional support, these challenges can perpetuate cycles of attrition that limit the diversity and innovation essential to STEM progress.

Recognizing the role of systemic structures, rather than individual deficits, reframes impostor syndrome as a product of inequitable environments rather than personal inadequacy. This shift encourages the creation of culturally responsive and identity-affirming practices that promote resilience, community, and empowerment (Davis et al., 2020). By fostering inclusive climates, developing mentorship programs, and integrating anti-bias training into academic culture, institutions can help mitigate the effects of impostorism and enhance the sense of belonging for women of color in STEM. Ultimately, addressing this issue is not only a matter of individual well-being but also a crucial step toward ensuring equity and excellence in the future of scientific education and innovation.

CONCEPTUAL CONTEXT

Impostor syndrome (IS), first conceptualized by Clance and Imes (1978), is characterized by persistent self-doubt and difficulty internalizing one's accomplishments despite clear evidence of competence. Within STEM education,

scholarship consistently demonstrates that IS disproportionately affects women of color not as an isolated psychological tendency but as an experience shaped by intersecting systems of race, gender, and institutional power.

From an intersectional perspective, impostor feelings emerge at the convergence of racialized and gendered expectations embedded within predominantly white and male-dominated STEM environments, where women of color are often required to continually validate their legitimacy and intellectual authority (Baumann et al., 2020; Kanatova, 2023; Lige et al., 2016). These conditions produce a persistent dissonance between demonstrated achievement and perceived inadequacy, reinforcing internalized narratives that question belonging and competence.

Critical consciousness further illuminates how awareness of systemic inequities shapes the impostor experience for women of color in STEM. Research suggests that recognizing structural racism and bias can enable individuals to contextualize self-doubt as a response to exclusionary environments rather than personal failure, offering a potential source of psychological resilience (McGee et al., 2019; Stone et al., 2018). However, this heightened awareness can simultaneously intensify emotional labor, as women of color must continually navigate, interpret, and respond to inequities within academic and professional spaces that often remain resistant to change.

As a result, impostor syndrome functions not only as an internal psychological struggle but as an ongoing process of identity negotiation shaped by institutional cultures that marginalize racialized and gendered identities (Lige et al., 2016; McClain et al., 2016). Viewed through the combined lenses of intersectionality and critical consciousness, impostor syndrome among women of color in STEM reflects a dynamic interaction between structural inequity, identity-based expectations, and meaning-making processes. This synthesis underscores that impostor experiences are sustained not solely by individual self-perception but by institutional environments that normalize exclusion while placing the burden of adaptation on those most marginalized.

Underrepresentation and Lack of Role Models

Underrepresentation remains one of the most significant contributors to impostor syndrome among women of color in STEM. The scarcity of visible and relatable mentors or role models perpetuates a sense of professional and social isolation. Women of color in these disciplines frequently find themselves as “the only one” in classrooms, labs, or departments, which reinforces feelings of not belonging and fuels self-doubt (Muradoglu et al., 2022; Simon, 2021). The culture of “brilliance” that dominates STEM fields, where success is often attributed to innate talent rather than effort, further marginalizes women of color by perpetuating the stereotype that intelligence and competence are racially and

gendered traits (Muradoglu et al., 2022). Consequently, many internalize the belief that they must continually outperform peers to validate their presence, heightening both emotional strain and impostor experiences.

Racialized and Gendered Microaggressions in Academic Spaces

Microaggressions, everyday verbal, behavioral, or environmental slights that convey hostile or dismissive messages, are a persistent barrier to psychological well-being for women of color in STEM. These subtle yet pervasive forms of discrimination undermine confidence, reinforce negative stereotypes, and exacerbate impostor feelings (Bravata et al., 2020; Stone et al., 2018). For example, Black and Latina women often report being mistaken for administrative staff or questioned about their qualifications, reinforcing the message that they do not belong in academic spaces (Simon, 2021; Lige et al., 2016). Over time, such experiences erode self-esteem and create chronic emotional fatigue, as individuals must expend continuous psychological effort to resist and disprove these biases. Multiple studies confirm that exposure to racialized and gendered microaggressions correlates with increased anxiety, diminished confidence, and heightened impostorism among women of color (Bravata et al., 2020; Kuppusamy et al., 2022).

Beyond interpersonal experiences, institutional structures and cultures play a decisive role in perpetuating impostor syndrome. Academic environments that fail to support diversity or that normalize exclusionary practices reinforce the message that women of color are outsiders (McGee et al., 2019; Stone et al., 2018). Systemic inequities in hiring, mentorship, and recognition often leave these students and professionals navigating their educational trajectories without sufficient institutional support. The absence of inclusive policies and equitable mentoring opportunities intensifies the emotional labor associated with navigating these spaces, compounding existing impostor feelings (McGee et al., 2019; Muradoglu et al., 2022). Consequently, women of color in STEM are burdened not only by the internal struggle of impostorism but also by structural barriers that limit their access to affirmation, advocacy, and belonging (McClain et al., 2016; McGee et al., 2019).

Emotional and Psychological Impacts

The emotional and psychological ramifications of impostor syndrome (IS) are particularly pronounced among women of color in STEM education. These individuals often navigate academic environments that implicitly privilege whiteness and masculinity, fostering a persistent sense of not belonging or feeling like an “impostor” (Wang & Li, 2023). Research highlights that heightened self-doubt, isolation, and emotional exhaustion are common as women of color contend

with the dual pressures of succeeding in STEM while simultaneously countering racialized and gendered stereotypes (Mak et al., 2019; Wang & Li, 2023). The pressure to continually prove one's competence in spaces that question one's legitimacy contributes to a relentless cycle of anxiety and self-scrutiny, a cycle that can be psychologically taxing and lead to chronic stress and emotional fatigue (Wang & Li, 2023).

Moreover, impostor syndrome significantly disrupts identity formation and undermines a sense of belonging within academic and professional communities. For women of color, the intersection of racial identity with academic experiences deepens feelings of exclusion, inadequacy, and invisibility in predominantly white, male-dominated STEM environments. These compounded pressures are linked to adverse psychological outcomes, including elevated stress, anxiety, and burnout (Bravo & Stephens, 2023; Wang & Li, 2023). The urgency to address these emotional burdens is emphasized throughout the literature, as they carry profound implications for both short-term academic engagement and long-term mental health of women of color in STEM (Mak et al., 2019; Wang & Li, 2023).

Educational and Career Implications

The effects of impostor syndrome extend well beyond emotional distress, influencing educational persistence and career progression for women of color in STEM fields. Studies indicate that persistent self-doubt and perceived inadequacy are linked to decreased academic persistence, reduced engagement in challenging coursework, and lower retention rates among STEM majors (Bravo & Stephens, 2023; Luttenberger et al., 2019). In STEM courses structured around high-stakes assessments, competitive grading norms, and "weed-out" instructional cultures, students who experience impostor feelings may interpret routine struggle as confirmation that they do not belong, leading to reduced participation, avoidance of office hours, and disengagement from collaborative learning opportunities.

The internalization of impostor feelings can also discourage students from seeking mentorship, applying for competitive opportunities, or envisioning themselves as capable professionals in their disciplines. This self-limiting behavior reflects a broader pattern of attrition in which minority women are disproportionately represented among those who leave STEM programs prematurely (Luttenberger et al., 2019; Mohtar et al., 2019). When students withdraw from mentorship and research apprenticeships, they lose critical opportunities to develop disciplinary identity and build professional confidence within STEM.

Furthermore, many women of color experiencing IS report attributing their success to external factors, such as luck or timing, rather than to their own competence or effort (Bolatlı & Korucu, 2018; Luttenberger et al., 2019). This attribution pattern can shape students' responses to evaluative feedback,

reinforcing avoidance of advanced coursework and high-impact learning opportunities that serve as gateways to graduate study and professional advancement. Consequently, impostor syndrome perpetuates a self-reinforcing cycle in which highly capable women of color withdraw from academic and professional pathways, ultimately reinforcing persistent patterns of underrepresentation and inequity within advanced STEM careers (Bravo & Stephens, 2023; Mohtar et al., 2019).

Identified Gap

While existing scholarship has documented the prevalence of impostor syndrome among women of color in STEM, fewer studies examine how institutional cultures and educational practices actively sustain these experiences. The interplay of underrepresentation, racialized microaggressions, and exclusionary academic climates remains underexplored as a systemic pattern rather than a series of isolated stressors. As a result, much of the literature stops short of interrogating institutional responsibility for addressing impostor syndrome within STEM learning environments. Future research must move beyond documenting psychological outcomes to examining how instructional practices, mentoring structures, and evaluative norms contribute to or mitigate impostor experiences. Centering intersectional perspectives that account for both individual resilience and institutional accountability is essential for advancing equity in STEM education. By fostering inclusive, identity-affirming academic environments, educators and policymakers can begin to disrupt the conditions that perpetuate self-doubt, disengagement, and attrition among women of color in STEM.

THEORETICAL FRAMEWORK

This study is guided by critical consciousness and intersectionality theory (Crenshaw, 1989), which highlights the interconnected nature of social categorizations such as race, gender, and other identity markers. Intersectionality posits that overlapping identities generate distinct experiences of marginalization and systemic inequity that cannot be understood in isolation (Crenshaw, 1989). By applying this framework, this paper provides a nuanced lens for examining how women of color in STEM experience impostor syndrome, not merely as a personal struggle with self-doubt, but as a complex response to structural exclusion, persistent racial and gender biases, and underrepresentation within academic and professional spaces (Rehman et al., 2023). This approach foregrounds the systemic and contextual factors that amplify impostor feelings, emphasizing that such experiences are rooted in social and institutional dynamics rather than individual inadequacy.

Critical consciousness, a concept originally developed by Paulo Freire (1970), provides a valuable lens for interpreting the experiences of women of color in STEM who encounter impostor syndrome. Freire coined the term to describe the ability to perceive and critically analyze the social, political, and economic structures that produce and sustain inequality, with an emphasis on empowering marginalized individuals to challenge oppression. Within the context of STEM education, critical consciousness highlights how awareness of systemic inequities such as racial and gender biases, underrepresentation, and institutional exclusion shapes perceptions of self-worth, coping strategies, and emotional responses (Naggar et al., 2023). Developing critical consciousness can empower women of color to reframe impostor feelings as consequences of biased environments rather than personal inadequacy. However, heightened awareness can also intensify stress, anxiety, or emotional fatigue when confronting persistent inequities (Naggar et al., 2023). Together with intersectionality theory, critical consciousness frames impostor syndrome as a dynamic interplay between individual identity, systemic oppression, and institutional climate. This perspective provides a nuanced understanding of the complex mechanisms that perpetuate self-doubt, emotional strain, and barriers to persistence among women of color in STEM, illuminating both the internal and structural dimensions of this phenomenon (Cokley et al., 2017; Naggar et al., 2023; Pastan et al., 2022; Rehman et al., 2023).

METHODOLOGY

This article employs a conceptual literature review methodology to examine impostor syndrome among women of color in STEM education. A conceptual review synthesizes existing empirical and theoretical scholarship to develop a comprehensive understanding of a phenomenon, identify patterns across studies, and illuminate gaps in the literature (Torraco, 2005). Rather than conducting a systematic search with quantitative synthesis, this review draws on a purposively selected body of peer-reviewed literature published primarily between 2015 and 2025, with foundational works included where relevant. Sources were identified through database searches across ERIC, PsycINFO, and Google Scholar using terms such as "impostor syndrome," "women of color," "STEM education," "intersectionality," "belonging," and "racial identity." Literature was selected based on relevance to the experiences of women of color in STEM educational and professional contexts. Selected studies were analyzed thematically and organized around intersecting structural, psychological, and pedagogical dimensions of impostor syndrome, guided by the frameworks of intersectionality (Crenshaw, 1989) and critical consciousness (Freire, 1970).

FINDINGS

Empirical evidence consistently demonstrates the pervasive influence of impostor syndrome (IS) on the academic and emotional experiences of women of color in STEM. Across studies, IS emerges as a widespread phenomenon rather than an isolated experience. For example, Kanatova (2023) reported that approximately 63% of women of color in STEM experience impostor feelings at various points in their academic trajectories, highlighting the scope and persistence of the phenomenon. This prevalence aligns with broader findings from a systematic review indicating strong associations between impostor syndrome and adverse psychological outcomes, including anxiety, diminished self-esteem, and reduced academic performance across diverse student populations (Baumann et al., 2020).

Beyond prevalence, research converges on the finding that social and institutional supports, while beneficial, are often insufficient to fully mitigate the effects of impostor syndrome. Lige et al. (2016), in a study of Hispanic undergraduate STEM majors, found that family and social support contributed to persistence in degree attainment but did not fully offset the psychological toll associated with impostor experiences. This pattern suggests that external encouragement alone cannot counteract the internalized self-doubt shaped by broader educational and cultural contexts, underscoring the need for more comprehensive institutional responses.

A growing body of evidence further indicates that impostor syndrome operates as a structural and cultural barrier within STEM education. Studies examining mentorship, community counterspaces, and supportive environments demonstrate that these resources can reduce impostor feelings; however, access to such supports remains uneven for women of color (McGee et al., 2019; Stone et al., 2018). Comparative analyses consistently show that women of color report lower levels of belonging, confidence, and perceived institutional support than their white or male peers, conditions that amplify impostor feelings rather than alleviate them (McClain et al., 2016; Lige et al., 2016). Collectively, these findings point to the role of institutional climate in sustaining impostor syndrome rather than resolving it.

Research also highlights the relationship between impostor syndrome, belonging, and persistence in STEM pathways. Tao and Gloria (2018) found that impostorism negatively influenced persistence, with a substantial proportion of women reporting that diminished belonging interfered with their academic engagement (Simon, 2021). Similarly, Chakraverty (2019) examined impostor experiences in graduate education, revealing that women and minoritized students faced distinct challenges during transitions from dependence to autonomy, linking impostor feelings to academic performance and professional development (Muradoglu et al., 2022). These studies collectively emphasize that impostor

syndrome intensifies at key academic transition points, particularly in environments characterized by heightened evaluation and competition.

Additional evidence underscores the role of representation and disciplinary culture in shaping impostor experiences. Joshi et al. (2025) found that "onlyness" being the sole representative of one's demographic group was significantly associated with heightened impostor feelings among Black women in computer science and engineering doctoral programs (Bravata et al., 2020). Muradoglu et al. (2022) further demonstrated that underrepresented minority women are especially vulnerable to impostor syndrome in fields that emphasize innate brilliance, reinforcing the importance of cultural context in how impostorism manifests (Kuppusamy et al., 2022). Parallel findings in leadership research indicate that perceptions of deservingness and effectiveness contribute to impostor experiences among women in high-status roles (Kark et al., 2021; Rohrmann et al., 2016), suggesting continuity between academic and professional contexts.

Broader reviews of the literature corroborate these patterns. Ménard and Chittle (2023) highlighted gender differences in the manifestation of impostor feelings among post-secondary students, particularly within STEM disciplines (Thompson & Kerr, 2023). Feenstra et al. (2022) extended this analysis by demonstrating how organizational contexts shape impostor experiences, advocating for approaches that account for external and structural influences rather than individual traits alone (Wang & Li, 2023). Similarly, Rainey et al. (2018) found that a strong sense of belonging mitigated impostor feelings and supported academic resilience in STEM, reinforcing the protective role of inclusive educational environments (Mak et al., 2019).

Evidence from professional training contexts further illustrates the long-term implications of impostor syndrome. Gottlieb et al. (2020), in a scoping review of physicians and trainees, linked impostor feelings to burnout and job dissatisfaction, outcomes that resonate with patterns observed in STEM education and workforce settings (Bravo & Stephens, 2023). Collectively, this body of empirical evidence demonstrates that impostor syndrome among women of color in STEM is shaped by interrelated psychological, cultural, and institutional factors, reinforcing the need for strategies that move beyond individual coping toward systemic transformation in educational environments.

Table 1

Thematic Summary of Impostor Syndrome Among Women of Color in STEM

Theme	Key Findings
Prevalence	Approximately 63% of women of color in STEM report impostor feelings; IS is associated with anxiety, reduced self-esteem, and lower academic performance.

Underrepresentation & Isolation	"Onlyness" (being the sole demographic representative) intensifies impostor feelings; scarcity of role models perpetuates professional isolation.
Microaggressions & Bias	Racialized and gendered microaggressions erode confidence and reinforce impostor feelings; exposure correlates with increased anxiety and impostorism.
Psychological Consequences	IS is linked to chronic stress, emotional fatigue, burnout, and disrupted identity formation among women of color in STEM.
Educational & Career Impacts	IS reduces academic persistence, limits engagement in high-impact opportunities, and contributes to attrition and constrained career aspirations.
Institutional Climate	Exclusionary academic cultures and lack of inclusive policies sustain IS; sense of belonging mitigates impostorism and supports resilience.
Mentorship & Peer Support	Culturally responsive mentorship and peer networks reduce impostor feelings and improve persistence, though access remains uneven.

DISCUSSION

Impostor syndrome (IS) among women of color in STEM should not be understood solely as an individual psychological phenomenon but as a manifestation of broader structural inequities embedded within academic and professional environments. Empirical evidence consistently demonstrates that women of color experience compounded pressures arising from racialized and gendered bias, which intensify self-doubt, feelings of inadequacy, and emotional distress (Bravata et al., 2020; Ireland et al., 2018; Wei et al., 2024). These experiences are reinforced by institutional cultures and practices that marginalize contributions, undervalue achievements, and sustain norms that privilege dominant groups, thereby reproducing impostor feelings rather than alleviating them (Bravata et al., 2020; Cokley et al., 2017).

Synthesizing findings across the literature suggests that effective responses to IS must operate across multiple, interconnected levels rather than relying on individual coping strategies alone. Mentorship, institutional culture, and professional development emerge as mutually reinforcing mechanisms through which impostor syndrome can be mitigated. Mentorship relationships that validate identity and normalize challenge can interrupt internalized narratives of inadequacy, while inclusive institutional cultures reduce the frequency of experiences that trigger impostor feelings. When these elements are embedded and coordinated, women of color are more likely to experience affirmation, belonging, and sustained engagement in STEM environments. The literature identifies three

interrelated domains through which institutions can effectively address impostor syndrome: culturally responsive mentorship and peer support networks, identity-affirming institutional cultures, and targeted professional development and counseling interventions.

Foster Culturally Responsive Mentorship and Peer Networks

Mentorship programs that are culturally responsive and tailored to the unique experiences of women of color are essential for mitigating impostor syndrome in STEM education. Such programs provide more than academic guidance; they offer emotional validation and role modeling that directly counters the isolation and self-doubt these students often experience Mentors who understand the sociocultural and structural challenges students face, including racialized microaggressions, underrepresentation, and gender bias, can help them contextualize their experiences, reframe perceived failures, and develop resilience (Ireland et al., 2018; Wei et al., 2024). Research indicates that students who engage with culturally responsive mentors report increased self-efficacy, greater persistence in their STEM programs, and higher levels of satisfaction with their academic experiences.

Peer networks serve as a complementary support mechanism, providing opportunities for students to share experiences, exchange coping strategies, and cultivate a sense of belonging. These networks can include formalized cohort programs, student-led organizations, or virtual communities that connect women of color across institutions. By creating spaces for collective identity and mutual encouragement, peer networks reduce feelings of "onlyness" and foster emotional and social resilience (Bravata et al., 2020; Cokley et al., 2017). Furthermore, evidence suggests that participation in peer networks correlates with improved academic performance, increased persistence in STEM majors, and a higher likelihood of pursuing advanced degrees. In combination, culturally responsive mentorship and robust peer networks function as protective factors against the psychological and structural pressures that exacerbate impostor syndrome, ultimately contributing to retention, empowerment, and long-term success for women of color in STEM.

Build an Institutional Culture that Affirms Identity and Belonging

Institutional commitment to diversity, equity, and inclusion (DEI) is essential for countering the deleterious effects of impostor syndrome (IS) among women of color in STEM. When institutions intentionally cultivate environments that affirm the identities and experiences of underrepresented students, they foster psychological safety, enhance self-efficacy, and reduce feelings of isolation, all of which are critical for persistence and academic success (Castle et al., 2024; Wei et

al., 2024). Policies and initiatives that actively combat racial and gender biases are pivotal for promoting equitable participation in STEM, including inclusive hiring practices, mentorship programs targeting underrepresented faculty and students, and curriculum revisions that highlight contributions of diverse scientists (Rohrmann et al., 2016; Walters & McNeely, 2010).

Studies indicate that institutions with higher representation of women of color in faculty and leadership positions report greater student engagement and persistence, as visible role models reinforce a sense of possibility and professional legitimacy (Castle et al., 2024). Inclusive curricula that integrate diverse perspectives and challenge dominant narratives can mitigate feelings of "otherness," validating students' cultural and intellectual identities and creating stronger connections between self-perception and academic achievement (Rohrmann et al., 2016; Wei et al., 2024).

Institutional recognition of diverse achievements, through awards, publications, and leadership opportunities, counteracts the internalized self-doubt characteristic of IS and reinforces the message that women of color's expertise and accomplishments are legitimate and valued (Walters & McNeely, 2010). Fostering a campus culture that normalizes belonging through peer networks, affinity groups, and support centers further reduces social isolation and enables students to collectively navigate structural and interpersonal barriers (Castle et al., 2024). By implementing these comprehensive strategies, institutions can move beyond superficial DEI efforts and create systemic change that affirms identity, validates contributions, and cultivates belonging, ultimately reducing the psychological burden of impostor syndrome and promoting long-term success for women of color in STEM (Castle et al., 2024; Rohrmann et al., 2016; Walters & McNeely, 2010; Wei et al., 2024).

Implement Professional Development

Implementing professional development and counseling programs specifically tailored to the intersectional experiences of women of color in STEM is critical for mitigating the impacts of impostor syndrome (IS). These programs offer targeted strategies to address the complex interplay of race, gender, and academic stress, equipping students with tools to reframe challenges, manage emotional exhaustion, and cultivate resilience in high-pressure environments (Dong, 2024; Eastman et al., 2017; Wei et al., 2024).

Professional development initiatives can include workshops on navigating microaggressions, leadership training, stress management, and identity-affirming skill-building, all designed to bolster self-efficacy and reinforce a sense of belonging. Counseling programs that incorporate culturally responsive practices and acknowledge the unique pressures faced by underrepresented groups have been shown to reduce anxiety, enhance coping mechanisms, and prevent burnout,

ultimately supporting both academic persistence and professional growth (K.H. & Menon, 2020; Kuppusamy et al., 2022).

By creating structured opportunities for reflection, mentorship, and guided skill development, these interventions help women of color reinterpret experiences of self-doubt as responses to systemic inequities rather than personal inadequacy, thereby fostering long-term psychological well-being. Integrating professional development and counseling into STEM programs represents a vital institutional strategy for reducing the hidden burdens of impostor syndrome while promoting equity, retention, and success across academic and professional pathways (Dong, 2024; Eastman et al., 2017; K.H. & Menon, 2020; Kuppusamy et al., 2022; Wei et al., 2024).

IMPLICATIONS

Future research must prioritize longitudinal, intersectional, and mixed-methods approaches to comprehensively examine the experiences of women of color in STEM who encounter impostor syndrome (IS). Longitudinal studies can track the development, persistence, and long-term consequences of IS across academic and professional trajectories, providing insight into how psychological, social, and institutional factors interact over time to influence outcomes such as retention, persistence, and career progression (Bravata et al., 2020; Gottlieb et al., 2020; Rohrmann et al., 2016). By capturing changes at multiple stages, undergraduate education, graduate training, and early career experiences, researchers can identify critical intervention points where institutional support and mentorship can have the greatest impact.

Intersectional studies that explicitly consider the simultaneous influences of race, gender, socioeconomic status, and other identities are essential to understanding how overlapping forms of marginalization shape experiences of self-doubt, stress, and exclusion (Castle et al., 2024; Cokley et al., 2017; Ireland et al., 2018; Yan, 2022). Such analyses allow researchers to move beyond generalized conclusions and instead identify the unique structural and cultural barriers faced by specific subgroups of women of color. This approach can also uncover protective factors and resilience strategies that are culturally and contextually relevant, informing the design of more effective, targeted interventions.

Additionally, research should investigate the efficacy of institutional interventions, including mentorship programs, professional development initiatives, curricular reforms, and culturally responsive counseling, in reducing IS and promoting academic and career success. Evaluating both short-term outcomes (e.g., self-efficacy, confidence, engagement) and long-term effects (e.g., persistence in STEM, career advancement, leadership attainment) will provide actionable evidence for institutions aiming to improve equity and belonging in STEM environments (Bravata et al., 2020; Gottlieb et al., 2020; Rohrmann et al.,

2016). Incorporating qualitative methods such as interviews, focus groups, and narrative inquiry can further illuminate the lived experiences, coping strategies, and perceptions of women of color, offering nuanced insights that quantitative metrics alone may overlook.

Finally, integrating intersectionality as a core metric in research methodologies ensures that analyses account for the complexity of systemic inequities, identity negotiation, and institutional climate in shaping experiences of impostorism. By doing so, scholars can produce findings that inform evidence-based, culturally responsive policies and practices aimed at fostering equity, resilience, and inclusion in STEM education and professional environments (Castle et al., 2024; Cokley et al., 2017; Ireland et al., 2018; Yan, 2022). Expanding research in these directions is essential not only for advancing scholarly understanding but also for guiding actionable institutional reforms that directly support the success and well-being of women of color in STEM.

CONCLUSION

The persistence of impostor syndrome among women of color in STEM underscores the systemic inequities embedded within academic culture and institutional practice. These inequities not only undermine individual self-efficacy but also create sustained barriers to academic achievement, retention, and career advancement (Eastman et al., 2017; Rohrmann et al., 2016; Wei et al., 2024). The documented relationship between impostor feelings and educational outcomes highlights the urgency of addressing both personal experiences and the institutional conditions that give rise to them (Bravata et al., 2020; Gottlieb et al., 2019).

This conceptual review contributes to the STEM education literature by synthesizing recent scholarship through an intersectional lens that foregrounds the interaction between identity, institutional climate, and educational practice. Rather than treating impostor syndrome as an individual deficit, this review clarifies how impostor experiences among women of color are shaped by underrepresentation, exclusionary cultures, and inequitable pedagogical environments. By organizing existing research thematically, the review illuminates patterns across psychological, educational, and career domains and identifies institutional leverage points for change.

Addressing impostor syndrome effectively requires coordinated, systemic responses that extend beyond individual coping strategies. Higher education stakeholders must implement comprehensive approaches that include culturally responsive mentorship, identity-affirming institutional cultures, and accessible mental health supports to foster equitable participation, enhance self-efficacy, and promote resilience among women of color in STEM (Castle et al., 2024; Walters & McNeely, 2010). Ultimately, confronting impostor syndrome as a structural and

educational issue positions institutions to advance social justice, improve retention and persistence, and cultivate more inclusive and equitable STEM learning and professional environments.

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Bio

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