

Beyond Representation: Mechanisms of Culturally Affirming Mentorship for Black and Latinx Students in STEM

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ABSTRACT

Despite efforts to broaden participation in STEM, Black and Latinx students often lack access to culturally resonant role models. We report a mixed-methods study at a minority-serving institution (201 survey respondents plus focus groups) that distinguishes three dimensions of mentorship impact: professional competence, authenticity, and cultural resonance. Competence emerges as a baseline expectation, while authentic narratives of struggle reduce psychological distance to career paths. Cultural resonance is widely valued but intersectionally patterned, with women demonstrating substantially stronger endorsement of demographic alignment. By disentangling these mechanisms, this work clarifies how culturally affirming role models function in STEM mentorship ecosystems.

CCS CONCEPTS

• Social and professional topics → *Computing education*.

KEYWORDS

Culturally affirming mentorship, STEM equity, Intersectionality, Identity-safe dialogue, Mentorship ecosystems

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1 Introduction

Persistent inequities continue to shape participation and advancement in science, technology, engineering, and mathematics (STEM), particularly for Black and Latinx students.



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Although institutions have implemented bridge programs, scholarship initiatives, and mentorship networks to broaden participation, representation gains remain modest and uneven [1, 2]. Black and Latinx individuals remain underrepresented in the U.S. STEM workforce relative to their share of the population, and women from these backgrounds constitute a particularly small proportion of STEM professionals [3, 4]. These disparities are not solely attributable to differences in preparation or interest; they are reinforced by structural conditions, including limited access to mentorship, culturally unresponsive environments, and the scarcity of visible figures whose trajectories resonate with students' lived experiences [5, 6, 7].

Mentorship has been consistently associated with improved self-efficacy, academic persistence, and career advancement in STEM [8, 9]. However, much of the existing literature treats mentorship as uniformly beneficial, without distinguishing how specific dimensions of mentorship shape its impact. Representation is often framed as inherently motivating, yet less attention has been paid to the mechanisms through which role models exert influence. Do students respond primarily to demographic similarity? To professional competence? To authentic narratives of struggle and resilience? Distinguishing these dimensions is important as they may operate through different psychological mechanisms and shape how students interpret, relate, to and internalize role models' trajectories. Treating relatability as a single construct risks obscuring how specific qualities, such as shared background, demonstrated expertise, or transparency about challenges, shape whether role models are perceived as attainable, trustworthy, and relevant. This raises an additional question of how these dimensions vary across intersectional positions such as race and gender.

Existing research suggests that relatable role models can enhance belonging and motivation [5, 10]. At the same time, scholars caution that not all role models are equally effective; highly exceptional figures can inspire admiration without fostering identification [11]. Narratives that include effort, adversity, and recovery can make success appear more attainable [12]. Yet, empirical work rarely disentangles competence, authenticity, and cultural resonance as distinct but interacting dimensions of mentorship impact. Moreover, when culturally resonant role models are absent, little is known about how students navigate that scarcity.

This study addresses these gaps through a mixed-methods investigation of Black and Latinx STEM students at a minority-serving institution. Rather than asking whether culturally affirming role models matter, we examine how and for whom they matter. We analytically differentiate between three dimensions of mentorship impact: professional competence, authenticity and navigational realism, and cultural resonance. In addition, we examine how students respond when access to relatable role models is limited.

Our findings demonstrate that competence establishes credibility, while authenticity and cultural resonance shape how students relate to and internalize role models' trajectories. At the same time, substantial proportions of students report that they lack access to relatable role models, revealing structural gaps that can shift additional motivational and navigational responsibilities onto students.

This work contributes to equity-oriented STEM education research in three ways. First, it disentangles the mechanisms of mentorship impact rather than treating representation as symbolic visibility. Second, it empirically examines the intersectional variation in how cultural resonance is valued across gender and race groups. Third, it highlights how structural scarcity shapes students' navigational strategies and may shift additional motivational and identity-related responsibilities onto them.

By focusing student perspectives while situating mentorship within broader institutional conditions, this study advances a more precise account of how role models function within STEM mentorship ecosystems. The following section situates this work within the relevant theoretical frameworks and the prior literature before articulating the study's research questions.

2 Theoretical Framework and Related Literature

This study builds on equity-oriented scholarship in STEM education by examining how role models and mentors function as relational mechanisms within structurally unequal environments. Rather than treating representation as symbolic visibility alone, we conceptualize culturally affirming role models through three interrelated dimensions: professional competence, authenticity and navigational realism, and cultural resonance. These dimensions are grounded in culturally relevant pedagogy, motivational theory, and prior research on mentorship and representation in STEM.

2.1 Culturally Relevant Pedagogy and Cultural Resonance

Our design is informed by Culturally Relevant Pedagogy (CRP) [13], which emphasizes that students' identities and lived experiences are not peripheral to learning but central to it. CRP argues that effective educational environments validate cultural identity while fostering academic excellence and critical awareness. Extending this framework to mentorship, we posit that culturally affirming role models do more than demonstrate success; they validate identity, contextualize structural barriers, and signal belonging.

Prior work has shown that exposure to relatable role models can strengthen students' self-efficacy and sense of belonging in STEM [5, 10]. However, much of this literature emphasizes representation broadly, without distinguishing how specific dimensions of relatability operate. In this study, we differentiate between demographic alignment (e.g., shared race or gender) and experiential resonance (e.g., shared struggles, cultural understanding), recognizing that affirmation may function through multiple channels.

2.2 Role Models, Mentors, and Relational Mechanisms

Role models and mentors serve distinct but overlapping functions in STEM pathways. Role models often inspire from a distance by expanding perceived possibilities [10, 11], while mentors provide direct guidance, feedback, and socio-emotional support [8, 14]. For underrepresented students, both roles can shape identity development and career persistence.

Importantly, prior research suggests that not all role models are equally effective. Perceived similarity, whether demographic or psychological, moderates impact [10, 12]. Students may respond more positively to role models whose trajectories appear attainable rather than exceptional to the point of distance. This insight motivates a closer examination of how competence, authenticity, and cultural alignment interact in shaping perceived impact.

2.3 Motivational Foundations: Competence and Authenticity

Expectancy-value theory posits that motivation depends on both perceived attainability and perceived value [15]. Relatable role models can increase expectancy for success by narrowing psychological distance between students and their aspirations. Attribution theory further suggests that exposure to narratives emphasizing effort, resilience, and growth fosters adaptive beliefs about achievement [16, 17].

Empirical research has identified an inverted-U relationship between perceived competence and inspiration: role models who are highly accomplished yet still relatable may be more motivating than those perceived as extreme outliers [10, 11]. Narratives that include struggle, failure, and recovery can therefore enhance identification and persistence [12]. These findings inform our distinction between baseline competence and authenticity-related qualities.

2.4 Intersectionality and Mentorship

Race and gender shape how mentorship relationships are experienced and valued. Students often report greater comfort and trust when mentors share aspects of their identity [7, 18]. Demographic alignment can reduce perceived social risk and increase psychological safety, particularly in environments where students encounter bias or marginalization [19].

At the same time, cross-identity mentorship relationships can be effective when mentors are culturally responsive and attentive

to students' lived realities [6, 20]. This suggests that cultural resonance may operate through both shared identity and shared understanding. However, less empirical work has examined how strongly these dimensions are endorsed across intersectional groups or how they compare to competence- and authenticity-based expectations.

2.5 Structural Scarcity and Mentorship Access

Despite recognition of mentorship's importance, access to culturally affirming role models remains uneven. Underrepresentation in faculty ranks, leadership positions, and industry pipelines limits visibility for many Black and Latinx students [19]. While prior work documents the benefits of mentorship, fewer studies examine how students respond when such mentorship is absent.

Understanding strategies of navigation under scarcity is critical. Students may rely on peer networks, intrinsic motivation, or aspirational self-positioning when culturally resonant figures are unavailable. Examining these responses provides insight into how structural gaps shape individual experiences.

2.5 Research Gap and Research Questions

Existing literature establishes that representation, relatability, and mentorship matter for underrepresented students in STEM. However, less attention has been paid to disentangling the mechanisms through which role models exert influence, to examining intersectional variation in how these mechanisms are valued, and to understanding how students navigate contexts of limited access. To address this gap, we investigate:

- **RQ1:** What characteristics make role models and mentors impactful for Black and Latinx students in STEM?
- **RQ2:** What strategies do students adopt in the absence of relatable role models or accessible mentorship opportunities?

3 Positionality Statement

This study was shaped by the complementary positions of the three authors. The first author is a student who identifies as Latina, situating her in a partial insider role with respect to the population of interest. This informed the framing of the research questions and the interpretation of participants' narratives, while reflective practices were used to examine assumptions and avoid over-identification. The second author is a professor who identifies as Latina, bringing both scholarly expertise and lived experience that further informed the study's conceptual framing and analytic decisions. The third author is a professor who does not share the focal demographic identities and occupies a more outsider position, contributing analytic distance and methodological rigor. Together, these perspectives supported a reflexive and balanced approach to the study's design and analysis.

4 Method

This study employed a sequential mixed-methods design to examine how Black and Latinx students conceptualize culturally affirming role models and mentors in STEM. The research combined a survey of undergraduate and graduate STEM students with follow-up focus group discussions to contextualize quantitative patterns with narrative depth. The study received Institutional Review Board (IRB) approval at the authors' institution prior to data collection.

4.1 Institutional Context

The study was conducted at a minority-serving institution (MSI) in the United States with a diverse STEM student population. STEM programs at the institution include disciplines across science, technology, engineering, and mathematics, including computer science, information systems, biology, chemistry, physics, engineering, mathematics, and statistics. Conducting the study within an MSI context allowed for examination of mentorship dynamics in an environment that, while more diverse than many STEM institutions, still reflects broader structural inequities in representation and access.

Although the institution enrolls a substantial number of students from historically marginalized backgrounds, representation at the student level does not necessarily translate into representation among faculty, senior leadership, or industry-facing role models. National patterns of underrepresentation in advanced academic ranks and STEM leadership positions remain reflected in local contexts. Examining mentorship dynamics within an MSI therefore allows analysis of structural scarcity even in environments with comparatively diverse student bodies.

4.2 Participants and Recruitment

Participants were required to (1) be enrolled in a STEM major and (2) self-identify as Black/African American and/or Hispanic/Latino/a/e. Recruitment was conducted through a combination of campus flyers, classroom announcements, and targeted outreach to student organizations serving underrepresented students in STEM, including the National Society of Black Engineers (NSBE), Society of Hispanic Professional Engineers (SHPE), Society for Advancement of Chicanos/Hispanics and Native Americans in Science (SACNAS), Society of Women Engineers (SWE), Louis Stokes Alliance for Minority Participation (LSAMP), and STARS Computing Corps.

A total of 201 students completed the survey and met inclusion criteria. Participants represented a range of academic levels, from first-year undergraduates to doctoral students, and spanned multiple STEM disciplines. Participants received a \$10 gift card for survey completion. Of the survey respondents who indicated their willingness to participate in follow-up sessions, 24 students participated in one of two focus group discussions (14 in the first session and 10 in the second), each lasting approximately 60 minutes. Focus group participants also received \$10 compensation.

4.3 Research Design Goals

The study was guided by three design goals:

1. **Center cultural relevance:** The instruments were designed to capture how students perceive and relate to role models and mentors through dimensions of shared identity, cultural understanding, and experiences of marginalization. Rather than imposing predefined definitions of impact, the study sought to foreground student interpretations of what makes role models meaningful.
2. **Differentiate mechanisms of influence:** Survey items were structured to distinguish between demographic alignment (e.g., shared race or gender), professional competence (e.g., expertise, passion), and authenticity-related qualities (e.g., transparency about struggle, resilience). This distinction allowed for analytic separation of baseline expectations from culturally resonant mechanisms.
3. **Examine navigation under scarcity:** The study explicitly investigated how students respond when culturally affirming role models are absent, capturing both perceived availability and compensatory strategies.

These goals were informed by culturally relevant pedagogy and intersectional frameworks, which emphasize the role of identity, lived experience, and structural context in shaping educational trajectories.

4.4 Survey Instrument

The online survey was administered via Qualtrics and took an average of approximately 28 minutes to complete. The instrument consisted of 26 questions (excluding screener and demographic questions), with items developed and adapted from prior literature on mentorship, role model influence, and culturally relevant pedagogy, and iteratively refined to align with the study's analytic constructs. The instrument included:

- Likert-scale items ($n = 12$) using a 7-point scale ranging from "Strongly disagree" to "Strongly agree" assessing the perceived importance of shared race, shared gender, cultural understanding, and role models' experiences overcoming identity-linked challenges.
- Binary items ($n = 6$) assessing whether participants had identified role models on campus and in industry, as well as identity alignment.
- Multi-select items ($n = 3$) capturing valued role model qualities (professional competence, communication, empathy, transparency, resilience, and authenticity), presented without formal definitions to capture participants' interpretations.
- Open-ended prompts ($n = 5$) allowing participants to elaborate on mentorship experiences and comfort discussing identity-linked topics.
- Demographic questions capturing race/ethnicity, gender identity, academic year, and major.

Items were mapped conceptually to dimensions of cultural affirmation, competence, and authenticity to support subsequent analytic differentiation.

4.5 Focus Group Procedures

Following survey completion, two semi-structured focus groups were conducted to explore themes emerging from quantitative findings. The sessions were facilitated using a participant-centered approach, encouraging reflection on mentorship experiences, role model relatability, and strategies for navigating STEM pathways.

Prompts invited discussion of:

- Characteristics of impactful role models and mentors,
- The role of shared identity in mentorship relationships,
- Experiences discussing race, gender, or discrimination,
- Strategies for navigating STEM in the absence of representation.

Sessions were audio-recorded and professionally transcribed.

4.6 Quantitative Data Analysis

Survey responses were restricted to completed surveys with documented consent. Descriptive statistics were computed to determine overall endorsement rates of culturally affirming characteristics and role model qualities.

To examine intersectional variation, chi-square tests were conducted comparing endorsement rates by gender and race group. Logistic regression analyses were used to estimate the odds of endorsing specific identity-based characteristics while controlling for race group and academic year. Odds ratios and 95% confidence intervals are reported where relevant. All regression models were examined for multicollinearity and no violations were detected. Multi-select quality items were analyzed by calculating selection frequencies and subgroup comparisons to distinguish broadly shared expectations from intersectionally differentiated preferences.

4.7 Qualitative Data Analysis

Open-ended survey responses and focus group transcripts were analyzed using a two-stage coding process. First, open coding was conducted to identify recurring themes related to cultural resonance, authenticity, competence, scarcity, and compensatory strategies. Second, axial coding was used to refine and connect themes across participants.

Two researchers independently coded a subset of transcripts to establish a shared coding framework. Inter-rater reliability for the independently coded portion achieved a Cohen's κ of 0.87, indicating strong agreement. Discrepancies were resolved through discussion, and the refined codebook was applied to the remaining data.

4.8 Mixed-Methods Integration

Quantitative and qualitative findings were integrated through triangulation. Survey results identified broad patterns of endorsement and subgroup differentiation, while qualitative narratives provided contextual explanation for how and why those patterns manifested. This integration strengthened interpretive validity and allowed for mechanism-level interpretation of mentorship dynamics.

5 Results

This section integrates survey data ($N = 201$) and focus group narratives to address (RQ1) what characteristics make role models and mentors impactful for Black and Latinx students in STEM, and (RQ2) how students navigate the absence of relatable role models. The survey sample included 111 women and 85 men (with a small number identifying outside binary categories), and 124 Black/African American and 77 Latinx respondents spanning undergraduate and graduate STEM programs. Agreement percentages ("Agree %") reflect the proportion of responses in the upper three categories of the 7-point scale (*Somewhat agree*, *Agree*, or *Strongly agree*). Group comparisons were conducted using chi-square tests, and logistic regression models controlled for race group and academic year as specified in the corresponding analyses. We have identified survey participants with the letter "S" whereas group discussion participants are mentioned using the letter "G".

Item (Agree %)	Women	Men	<i>p</i> -value
Same race/ethnicity important	81.1	65.9	.024
Same gender important	87.4	37.6	< .001
Role model is person of color	82.0	55.3	< .001
Understands my culture	92.8	78.8	.008
Overcame identity challenges	83.8	78.8	.482

Table 1. Endorsement of Culturally Affirming Characteristics by Gender

Item (Agree %)	Black	Latinx	<i>p</i> -value
Same race/ethnicity important	78.2	63.3	.058
Role model is person of color	74.1	57.1	.039
Understands my culture	87.1	83.7	.720
Overcame identity challenges	82.3	79.6	.831

Table 2. Endorsement of Culturally Affirming Characteristics by Race Group

5.1 RQ1: Characteristics of Impactful Role Models and Mentors

5.1.1. Cultural Affirmation as a Central but Differentiated Dimension. Across the entire sample endorsement of culturally affirming characteristics was consistently high. Approximately three-quarters of the respondents indicated that it was important for a role model to share their race or ethnicity, and nearly two-thirds indicated that shared gender was important. More than 70% valued role models who are people of color, and 86.6% emphasized the importance of cultural understanding. Similarly, 81.6% reported that it was important for role models to have overcome challenges related to race, ethnicity, or gender. These patterns were reflected in participants' descriptions of meaningful role models, particularly in terms of representation and shared experience. As one student explained, "a role model to me is someone who shows a path exists for a Black American like me, and to not be discouraged" [S85], highlighting how representation signals possibility.

Although endorsement levels were broadly elevated, closer examination revealed meaningful intersectional differentiation. The gender differences were particularly pronounced (Table 1). Women were significantly more likely than men to endorse the importance of same-gender role models (87.4% vs. 37.6%, $\chi^2(1) = 50.75$, $p < .001$), a pattern reflected in participants' accounts of comfort and communication. As one student noted, "I would prefer a female because I am more comfortable around females and would probably refrain from certain conversations if they were a male" [S163], suggesting that shared gender identity can shape openness in mentorship relationships. Women were also more likely to prioritize shared race or ethnicity (81.1% vs. 65.9%, $p = .024$), role models being people of color (82.0% vs. 55.3%, $p < .001$), and cultural understanding (92.8% vs. 78.8%, $p = .008$). These patterns were further reflected in participants' hesitancy to engage in certain discussions without shared or understood experiences, as illustrated by several students: "I wouldn't feel comfortable talking about race and gender issues...because I would fear they wouldn't care or downplay my struggles or that they wouldn't understand and wouldn't try either" [S100], "I would not feel comfortable discussing racial/gender ceilings...women, especially Black women, are somewhat confined to a box of what people think they should be or do" [S174], and another noting that "it's hard to address issues where there's a lack of shared perspective" [S80]. Together, these findings suggest that intersectional alignment shapes not only preferences for role model characteristics, but also the perceived safety and depth of mentorship interactions.

Regression analyses controlling for race group and academic year confirmed these patterns. Women had over eleven times the odds of endorsing the importance of same-gender role models (OR = 11.27, 95% CI [5.51, 23.07], $p < .001$) and approximately twice the odds of endorsing shared race importance (OR = 2.12, 95% CI [1.08, 4.14], $p = .028$). These findings indicate that cultural affirmation is not monolithic; rather, its salience varies intersectionally, with women placing substantially stronger emphasis on demographic and cultural alignment.

The differences by race group were more moderate (Table 2). Black respondents were more likely than Latinx respondents to endorse the importance of having a role model who is a person of color (74.1% vs. 57.1%, $p = .039$). However, the acceptance of cultural understanding and the challenge of overcoming identity-linked challenges remained high in both groups. This suggests that experiential resonance may function as a broadly shared priority, while certain dimensions of demographic alignment vary between racial groups. Participants' reflections further illustrate how similarity is often valued but not strictly required. For example, one student explained, "they don't have to be Black, but they just have to be a minority or from an immigrant family...I just don't want to feel like the complete black sheep" [G5], while another described similarity as enhancing motivation, noting that "those who are more similar to me or have a similar background are the ones that...kind of motivate you" [G2].

Taken together, these findings indicate that cultural affirmation plays a central role in shaping perceptions of impactful role models, but its importance is not uniform. Instead, its meaning and weight shift based on how multiple aspects of background influence both relatability and the ability to engage in meaningful open dialogue within mentorship relationships.

5.1.2. Competence as Baseline Expectation. In addition to demographic and cultural alignment, students overwhelmingly endorsed professional competence. Expertise in one's field (87.6%) and passion for the discipline (85.6%) were among the most frequently selected qualities. Communication ability, leadership, empathy, and approachability were also widely endorsed.

Unlike identity-based items, competence-related qualities showed relatively limited subgroup differentiation. This pattern suggests that expertise and passion function as baseline expectations for role model legitimacy. Across gender and race groups, students appear to expect competence as a prerequisite for influence.

This expectation was echoed in participants' descriptions of what makes someone worth emulating. One student reflected that role models are individuals who have overcome difficulty explaining that "this person... did something that was difficult and was hard, and I feel like I can do it as well" [G2]. Others emphasized skill and achievement more directly, with one participant stating that "someone who knows what they are doing... because at the end of the day they got to where they are because of their abilities" [S88], regardless of background.

Participants also connected competence to effort and perseverance. As one student described, "I look for someone who worked for what they have and has faced adversity in their journey. These challenges build character and I would love to hear about how they pushed through for their passions" [S53]. These accounts suggest that competence is not only defined by expertise but also by the process of overcoming challenges to reach that expertise, reinforcing its role as a baseline expectation for role model credibility and influence.

5.1.3. Authenticity and Navigational Realism. Beyond competence, students strongly endorsed qualities reflecting authenticity and navigational realism. Majorities selected transparency about struggles (66.2%), realism about the challenges of STEM pathways (65.2%), resilience in setbacks (65.2%), willingness to acknowledge uncertainty (65.7%), and experience with failure (62.2%).

These findings indicate that impactful role models are not defined solely by achievement, but by how they contextualize that achievement. Emphasizing the importance of learning from setbacks, one participant noted that "failures are more important than successes...because knowing how to respond when things go wrong...that's where the real value is" [G8]. Similarly, reflecting skepticism towards idealized narratives, another participant observed that "so often, [public figures'] stories are glorified in specific aspects, but the true situations of how they reached those positions are buried or not even told" [G4]. Participants also highlighted the value of realistic accounts of lived experience and hardship over formal accomplishments, as illustrated by one student who explained that it's more important that they share their experience in life and how to overcome hardships...rather than achievements" [S197]. Authenticity, therefore, appears to operate as a bridge between aspiration and attainability, narrowing the psychological distance between students and their goals. Endorsement of authenticity-related qualities was broadly shared across groups, suggesting that while demographic alignment varies, transparent and realistic narratives are widely valued as central to impactful role modeling.

5.2 RQ2: Navigating the Absence of Relatable Role Models

5.2.1. Structural Scarcity. Despite strong endorsement of culturally affirming characteristics, access to such figures was limited. Only 30.3% of respondents reported having found a role model on campus, and 40.8% reported having found one in industry. Nearly 70% indicated that they had not found a campus role model, and close to 60% reported lacking one in industry.

Participants described limited visibility of faculty and industry professionals who reflected their identities, particularly in senior or leadership positions. As one participant explained, "physically within my field, I've never seen anyone, especially who's Black or African, taking up a major role" [G4], pointing to a lack of visible representation. Others described a broader sense of isolation or disconnection "I haven't really seen anyone in faculty or industry with the same background as me...there's a disconnect from role models" [G1].

Together, this quantitative evidence of scarcity, combined with qualitative accounts of invisibility, highlights a structural gap between students' mentorship preferences and institutional availability.

5.2.2. Compensatory Strategies and Peer Reliance. In response to this scarcity, students described adopting alternative strategies. Peer networks emerged as significant sources of motivation and guidance, particularly peers slightly ahead in internships, research roles, or academic milestones. Emphasizing the role of connection-building, one participant noted that “making some of those connections can compensate for a lack of role models” [G4]. Observing peers succeed appeared to provide attainable models of progression.

Other students emphasized intrinsic motivation and personal commitment to STEM independent of visible representation. Reflecting this perspective, one participant explained that, “I never really thought of anybody that would make me want to stay in STEM...because that’s just what I want to do” [G6], illustrating how personal interest can sustain engagement even in the absence of relatable figures. Some students further reframed the absence of role models as motivation to “become” the representation they wished to see. As one participant articulated, “if there’s no one there, then what can I do to fill that spot? I might as well just make a name for myself” [G4], highlighting a shift from seeking representation to embodying it. These responses suggest that students do not passively experience scarcity; rather, they actively compensate through peer engagement, resilience, and identity repositioning.

These findings suggest that in the absence of culturally affirming role models, students may assume additional motivational and navigational responsibilities. While these strategies demonstrate agency, they also underscore the structural dimension of mentorship inequity, as the burden of compensation shifts to those navigating underrepresentation.

6 Discussion

This study examined (RQ1) what makes role models and mentors impactful for Black and Latinx students in STEM, and (RQ2) how students navigate contexts in which culturally affirming figures are scarce. The findings move beyond descriptive claims that representation matters by empirically identifying distinct relational mechanisms through which mentorship operates in STEM contexts. Together, these dimensions clarify how role models function as relational mechanisms within institutionally constrained environments.

6.1 From Visibility to Cultural Resonance

Prior research has emphasized the importance of representation in STEM, particularly for students from historically marginalized groups. The present findings refine this understanding by demonstrating that representation operates through culturally resonant mechanisms rather than mere demographic visibility. Although high proportions of students endorsed shared race, shared gender, and cultural understanding as important, these endorsements were intersectionally patterned. Women, in particular, were significantly more likely to prioritize demographic alignment and cultural resonance.

This pattern suggests that cultural affirmation is closely linked to identity-based vulnerability. For students navigating

gendered and racialized STEM environments, shared identity may reduce perceived social risk, increase relatability, and enhance psychological safety. In this sense, culturally affirming role models do not simply symbolize inclusion; they enable more secure engagement within environments where marginalization is experienced unevenly.

Importantly, differences by race group were more moderate than differences by gender, indicating that cultural understanding and experiential resonance are widely valued by Black and Latinx respondents. Thus, cultural affirmation appears to function at both demographic and experiential levels, with intersectionality shaping the intensity and form of that valuation.

6.2 Competence and Authenticity as Complementary Mechanisms

Across groups, professional competence functions as a foundational condition of legitimacy rather than a differentiating source of impact. However, competence alone does not fully explain motivational influence. Authenticity, particularly transparent narratives of struggle, uncertainty, and recovery, functions as a motivational bridge between aspiration and perceived attainability. When success is contextualized through navigational realism rather than exceptionalism, role models become not only admirable, but attainable.

This dual structure suggests a layered mechanism. Competence establishes authority, while authenticity narrows psychological distance. Transparent narratives of adversity appear to transform role models from distant exemplars into attainable figures. Students’ skepticism toward idealized success stories reinforces this interpretation: success without visible struggle may inspire admiration, but struggle contextualized through resilience appears to inspire identification.

Notably, authenticity-related qualities were broadly endorsed in all gender and race groups. This indicates that while demographic alignment may vary intersectionally, the desire for realistic and honest narratives is widely shared. Culturally affirming role models are therefore not defined solely by who they are, but by how they narrate and contextualize their journeys within systems of constraint.

6.3 Structural Scarcity and Student Responsibility

Despite strong endorsement of culturally affirming characteristics, a substantial proportion of students reported not having access to such figures on campus and in industry. This gap reveals a structural tension: students value culturally resonant mentorship, yet institutional contexts often fail to provide it.

Rather than disengaging, many students described compensatory strategies, including peer reliance, intrinsic motivation, and reframing absence as motivation to become future representation. While these strategies demonstrate agency and resilience, they also indicate a redistribution of motivational responsibility within mentorship ecosystems. Underrepresented students may experience increased responsibility to maintain their own participation in environments where structural support is limited.

This dynamic raises important equity concerns. When mentorship ecosystems rely on informal discovery rather than structured visibility, access becomes uneven. Emphasizing individual resilience can inadvertently obscure institutional responsibility to expand access to culturally affirming mentors and role models.

6.4 Psychological Safety in Identity-Linked Dialogue

The findings also illuminate the relational dimension of mentorship. Students frequently expressed a hesitation to discuss race, gender discrimination, or cultural marginalization with mentors who did not share aspects of their identity. This suggests that cultural resonance is related to conversational safety and the perceived legitimacy of identity-linked concerns.

Mentorship, therefore, functions not only as academic guidance, but also as a site for navigating structural inequities. Shared identity or cultural understanding can reduce anticipatory invalidation and enable a candid dialogue about bias and exclusion. In this way, culturally affirming mentors expand the scope of mentorship beyond technical development to include socio-emotional validation.

6.5 Implications for Mentorship Ecosystem Design

The findings suggest several implications for the equity-oriented mentorship design in STEM.

First, institutions should distinguish between competence and resonance. Recruiting highly accomplished speakers or mentors is insufficient if their narratives remain inaccessible or detached from lived realities. Structured opportunities for authentic storytelling, particularly those that focus on struggle, uncertainty, and recovery, may enhance identification and motivational impact.

Second, mentorship initiatives should account for intersectional variation. The pronounced gender differences observed here indicate that demographic alignment may carry different weights between groups. Designing mentorship ecosystems that offer multiple pathways to resonance, including demographic similarity, shared lived experience, or transparent narrative, may better accommodate diverse needs.

Third, institutions should address structural scarcity directly. When large proportions of students report lacking access to relatable role models, mentorship cannot remain incidental. Formalized visibility, intentional mentor matching, and institutional accountability mechanisms can reduce the burden currently placed on students to compensate for systemic gaps.

6.6 Advancing Equity-Oriented STEM Research

This study contributes to equity-oriented STEM research by empirically differentiating between baseline competence expectations, authenticity-driven attainability, and intersectionally patterned cultural affirmation mechanisms. It further demonstrates that authenticity functions as a motivational bridge, while structural scarcity suggests that students may assume additional motivational and identity-related responsibilities.

Instead of framing mentorship solely as interpersonal support, these findings position role models and mentors as relational mechanisms embedded within broader institutional structures. Understanding how competence, authenticity, and cultural resonance interact provides a more precise account of how mentorship shapes the experiences of Black and Latinx students in STEM contexts. By analytically separating competence, authenticity, and cultural resonance as distinct dimensions of mentorship impact, this study offers a mechanism-level framework that can inform both future empirical research and institutional design.

7 Limitations

Several limitations should be considered. **First**, the study was conducted at a single minority-serving institution, where institutional culture, regional demographics, and program structure may shape both the availability of role models and students' expectations of mentorship. The findings therefore may not generalize uniformly to predominantly white institutions or other STEM contexts. Comparative research across institutional types would clarify how mentorship mechanisms operate under varying structural conditions. **Second**, the data are cross-sectional and self-reported, capturing perceptions at a single point in time rather than longitudinal outcomes such as persistence or career trajectories. Although participants attributed motivational and relational significance to culturally affirming figures, causal claims about long-term impact cannot be made. **Third**, while the sample supported subgroup comparisons by gender and race group, some intersectional subgroups were too small for robust statistical analysis. Larger and more diverse samples could better examine how additional identity dimensions intersect with mentorship preferences. **Finally**, the survey relied on predefined categories of role model qualities. Although open-ended responses supplemented these measures, certain dimensions of cultural affirmation or mentorship dynamics may not have been fully captured. Longitudinal or ethnographic approaches may further illuminate how mentorship relationships evolve over time.

8 Design Implications

The findings suggest that effective mentorship ecosystems in STEM must address competence, authenticity, and cultural resonance simultaneously, rather than treating representation as a symbolic add-on.

8.1 Designing for Cultural Resonance, Not Just Visibility

Institutions often focus on increasing the visibility of diverse professionals. While representation is important, the results indicate that demographic similarity functions as a mechanism for psychological safety and identity validation, particularly for women. Mentorship initiatives should therefore move beyond passive visibility toward structured opportunities for demographic and cultural alignment, where feasible.

Where demographic matching is not feasible, training mentors to engage with identity-linked experiences thoughtfully and without minimization can help approximate cultural resonance. Mentorship preparation should include attention to how race, gender, and cultural context shape students' STEM experiences. Even well-designed systems must therefore remain attentive to how students experience residual gaps in access and ensure that mentorship support does not depend on informal discovery alone.

8.2 Foregrounding Authentic Narratives

Students overwhelmingly valued transparency about struggle, realism about STEM pathways, and resilience in the face of setbacks. Institutions may therefore consider designing mentorship programming that foregrounds authentic storytelling rather than polished success narratives. Panels, seminars, or digital storytelling initiatives that explicitly include accounts of uncertainty, failure, and recovery may help narrow the psychological distance between students and aspirational figures. Authenticity should not be incidental; it should be treated as a design feature of mentorship initiatives.

8.3 Reducing the Burden of Compensatory Responsibility

The findings also suggest that students often assume additional responsibility for maintaining engagement when culturally resonant mentorship is limited. Rather than abandoning STEM pathways, participants described relying on peer networks, intrinsic motivation, and aspirational self-positioning. These strategies reflect resilience, yet they signal an uneven distribution of support among mentorship ecosystems [21].

Institutions should therefore consider how mentorship structures can reduce the need for compensatory responsibility by ensuring that culturally resonant support is proactively integrated into formal systems. Such efforts require systematic pathways that ensure consistent exposure to culturally affirming figures. This may include formalized speaker series, curated alumni networks, structured peer-mentoring ladders, or institutional accountability metrics tied to representation in visible roles.

8.4 Mentorship as a Site of Identity-Safe Dialogue

Students expressed hesitation to discuss race, gender discrimination, or cultural marginalization with mentors who lack shared identity. Mentorship design should therefore account for the need for identity-safe spaces. Structured affinity groups, small-group dialogues, or layered mentorship models (e.g., combining technical mentors with identity-aligned mentors) may provide complementary forms of support. Recognizing mentorship as both technical guidance and socio-emotional validation expands the scope of mentorship design beyond academic advising alone.

8.5 Toward Mentorship Ecosystems Rather Than Individual Matches

Finally, the findings suggest that mentorship should not be conceptualized as a single dyadic relationship, but rather as an ecosystem composed of multiple sources of competence, authenticity, and resonance. Students may seek different dimensions from different individuals. Designing layered mentorship structures can therefore better reflect how students actually navigate support networks. For example, layered mentorship structures that combine technical advisors, identity-aligned mentors, and peer networks may better reflect how students distribute different forms of support across relationships. Such multi-layered models may reduce the burden on any single mentor while expanding opportunities for culturally resonant dialogue. By aligning mentorship design with these differentiated mechanisms, institutions can move beyond symbolic diversity efforts toward structurally responsive mentorship ecosystems that more equitably distribute support.

9 Conclusion

This study examined what makes role models and mentors impactful for Black and Latinx students in STEM and how students navigate contexts where culturally affirming figures are limited. The findings indicate that mentorship operates through interrelated mechanisms rather than representation alone. Role models are evaluated not only for their accomplishments, but for how those accomplishments are made attainable through authenticity, navigational realism, and cultural resonance. These dimensions shape how students interpret and internalize mentorship within unequal systems. Demographic and cultural alignment are intersectionally patterned, with gender emerging as a significant differentiator. Many students reported limited access to relatable role models in campus and industry settings. In response, they described relying on peer networks, intrinsic motivation, and aspirational self-positioning to sustain engagement. While these strategies reflect agency, they also suggest that institutional access gaps may shift additional motivational and navigational responsibilities onto underrepresented students. By distinguishing competence, authenticity, and cultural resonance, this study offers a mechanism-level account of culturally affirming mentorship in STEM. Advancing equity therefore requires more than increasing representation; mentorship ecosystems must be intentionally designed to ensure that culturally resonant support is systematic, sustained, and institutionally supported.

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