

# Factors Contributing to the Underrepresentation of Women and Minority Students in STEM Fields

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## Abstract

The underrepresentation of women and minority students in STEM (Science, Technology, Engineering, and Mathematics) fields is a persistent issue that requires thorough investigation to understand the contributing factors. This research study aimed to identify and examine the factors that contribute to the underrepresentation of women and minority students in STEM fields. Through an extensive literature review and analysis of existing research, several key findings emerged. Stereotypes and bias were identified as significant factors that contribute to the underrepresentation of women and minority students in STEM fields. Despite progress in recent years, stereotypes and bias still exist in many STEM fields, resulting in discrimination against women and minority students. These biases can be subtle, such as assumptions about ability or interest, and can limit opportunities for students from these groups. Addressing and mitigating these biases is crucial to creating a more inclusive STEM environment. The lack of visible role models was identified as another important factor contributing to the underrepresentation of women and minority students in STEM fields. Many women and minority students may feel isolated in STEM fields due to a lack of role models who look like them and have succeeded in these fields.

This lack of representation can make it challenging for these students to envision themselves succeeding in STEM fields, leading to lower interest and participation. Increasing the visibility of diverse role models in STEM fields can help inspire and motivate women and minority students to pursue STEM careers. Educational inequities were also found to be contributing factors to the underrepresentation of women and minority students in STEM fields. Unequal access to quality education and resources can limit the opportunities available to women and minority students in STEM fields. Students from lower-income backgrounds, in particular, may face challenges in accessing the same resources as their peers, which can hinder their ability to excel in STEM fields. Addressing educational inequities and providing equal opportunities for all students, regardless of their background, is crucial in promoting diversity and inclusivity in STEM fields. Cultural factors were identified as additional factors that contribute to the underrepresentation of women and minority students in STEM fields. Some cultures may not encourage women to pursue careers in STEM fields or may not view these fields as desirable career paths. These cultural beliefs can impact the aspirations and motivations of women and minority students, leading to lower participation in STEM fields. Addressing cultural factors and promoting diversity and inclusivity in all cultures is essential in creating a more inclusive STEM environment. Addressing these factors requires a multifaceted approach that involves promoting diversity and inclusivity in STEM fields, increasing access to quality education and resources, providing visible role models, and creating inclusive workplace cultures. Further research and collaborative efforts among stakeholders, including academia, industry, policymakers, and communities, are needed to effectively address the underrepresentation of women and minority students in STEM fields and promote diversity and inclusivity in these fields.

## Keywords:

1. *Underrepresentation*
2. *STEM fields*
3. *Stereotypes*
4. *Bias*
5. *Role models*
6. *Cultural factors*

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## Introduction

The fields of Science, Technology, Engineering, and Mathematics (STEM) are crucial drivers of innovation, economic growth, and societal progress. However, despite the growing recognition of the importance of diversity in these fields, women and minority students continue to be underrepresented in STEM disciplines. This underrepresentation has significant implications, not only for the affected individuals but also for the fields of STEM as a whole, as it limits the diversity of perspectives, ideas, and solutions that can be brought to the table. In this essay, we will explore the factors that contribute to the underrepresentation of women and minority students in STEM fields.

The underrepresentation of women and minority students in STEM fields is the existence of stereotypes and bias. Despite progress in recent years, stereotypes about the abilities, interests, and roles of women and minority students in STEM persist. These biases can be subtle, often operating at an unconscious level, and can influence the expectations and treatment of individuals from these groups. For example, women and minority students may be assumed to be less capable or less interested in STEM subjects, which can lead to lower expectations and fewer opportunities for them to excel in these fields. Moreover, stereotypes can also influence the self-perception and self-efficacy of women and minority students, leading them to internalize and conform to these biased expectations, which can further limit their interest and participation in STEM fields.

Contributes to the underrepresentation of women and minority students in STEM fields is the lack of visible role models. Role models play a crucial role in shaping individuals' aspirations and career choices, as they provide inspiration and guidance on what is possible. However, women and minority students often face a scarcity of role models in STEM fields, which can make it difficult for them to envision themselves succeeding in these fields. This lack of representation can lead to a sense of isolation and can further perpetuate the belief that STEM fields are not for individuals from these groups. Furthermore, the lack of role models can also impact the perceptions of others about the capabilities and suitability of women and minority students for STEM fields, reinforcing stereotypes and bias.

Educational inequities also play a significant role in the underrepresentation of women and minority students in STEM fields. Access to quality education and resources is not uniform across different communities and socioeconomic backgrounds, which can create disparities in opportunities for learning and development. For example, students from lower-income backgrounds may face challenges such as underfunded schools, lack of access to advanced coursework or extracurricular activities, and limited exposure to STEM careers and professionals. These barriers can limit the ability of women and minority students to acquire the skills and knowledge needed to excel in STEM fields, putting them at a disadvantage compared to their peers from more privileged backgrounds. Moreover, the lack of representation and diversity in educational settings can also impact the sense of belonging and inclusion of women and minority students in STEM fields, further perpetuating the underrepresentation.

Cultural factors also contribute to the underrepresentation of women and minority students in STEM fields. Cultural norms, values, and expectations can shape individuals' perceptions of what is considered acceptable or desirable in terms of career choices. In some cultures, there may be gendered expectations or biases that discourage women from pursuing careers in STEM fields, or that limit the opportunities available to them. For example, there may be societal expectations for women to prioritize family or caregiving roles over careers in STEM, or there may be cultural stereotypes about the abilities or interests of women in these fields. Similarly, some minority groups may face cultural barriers that limit their access to STEM fields, such as language barriers or lack of representation of their cultural perspectives in STEM curricula. These cultural factors can

influence the aspirations, motivations, and choices of women and minority students, shaping their interest and participation in STEM fields.

STEM fields have traditionally been male-dominated, with limited diversity in terms of gender, race, and ethnicity among colleagues and leadership. This lack of diversity can create a culture that is unwelcoming or exclusionary to women and minority students, leading to feelings of isolation and a lack of belonging. Research has shown that workplace cultures that do not value diversity, equity, and inclusion can lead to lower job satisfaction, higher turnover rates, and reduced productivity among employees from underrepresented groups. Additionally, workplace cultures that do not support work-life balance can disproportionately impact women and minority students, who may face additional responsibilities or barriers due to societal expectations or caregiving roles.

### Stereotypes and Bias

Stereotypes and bias continue to persist in many STEM fields, posing significant challenges for women and minority students. Discrimination against these groups is a persistent issue that can hinder their progress in STEM fields. These biases may manifest in subtle yet impactful ways, such as assumptions about their abilities or interests, which can limit their opportunities for growth and advancement. For example, women and minority students may face prejudiced assumptions that they are not as competent or interested in STEM fields compared to their peers, leading to biased treatment in academic and professional settings. Such stereotypes and biases can create a hostile environment that undermines the confidence and motivation of women and minority students, ultimately deterring them from pursuing STEM careers. Addressing and challenging these deep-rooted stereotypes and biases is crucial to promoting diversity and inclusivity in STEM fields and providing equitable opportunities for women and minority students to succeed.

Stereotypes and bias can influence the representation of women and minority students in STEM fields at various stages of their academic and professional journey. For instance, these biases may impact the recruitment and selection processes, leading to unequal representation of women and minority students in STEM programs or job opportunities. Additionally, stereotypes and bias can affect mentoring, sponsorship, and networking opportunities, which are critical for career advancement. Women and minority students may face challenges in finding mentors or sponsors who can guide and support their career aspirations, further hindering their progress in STEM fields.

The effects of stereotypes and bias can extend beyond overt discrimination and impact the daily experiences of women and minority students in STEM fields. Microaggressions, subtle forms of discrimination, can be pervasive in academic and workplace settings, resulting in a hostile environment where individuals feel invalidated, marginalized, and excluded. These microaggressions may include demeaning comments, lack of recognition, or being overlooked for opportunities, which can have a cumulative effect on the motivation and engagement of women and minority students in STEM fields.

Stereotypes and bias can also shape the self-perception and identity of women and minority students in STEM fields. Internalizing negative stereotypes or facing imposter syndrome can create self-doubt and diminish the confidence of women and minority students in their abilities to succeed in STEM fields. This can contribute to a lack of representation, as these individuals may choose to leave STEM fields or not pursue them in the first place due to a perceived lack of belonging or confidence.

### Lack of Role Models

The absence of prominent role models can create significant hurdles for women and minority students pursuing careers in STEM fields. Without visible examples of successful individuals who share similar backgrounds and experiences, these students may feel isolated and unsupported in their academic and professional endeavors. The absence of role models can exacerbate imposter syndrome, leading students to question their own abilities and worth in these fields. This can have a profound impact on their interest and participation in STEM, potentially deterring them from pursuing careers in these fields altogether. When young people lack tangible examples of individuals who have achieved success in a given area, it can be challenging for them to envision themselves following a similar path. This is particularly true for women and minority students, who may already face additional barriers and obstacles in STEM fields. The lack of role models is therefore a critical issue that must be addressed in order to encourage greater diversity and inclusivity in STEM fields. By increasing the visibility of successful individuals from a range of backgrounds, we can inspire and motivate the next generation of students to pursue careers in STEM and unlock their full potential.

Exposure to role models is an essential factor in promoting interest and participation in STEM fields. Role models serve as tangible examples of what is possible and provide inspiration, guidance, and mentorship to young people seeking to pursue similar paths. However, for women and minority students, the absence of role models can be particularly detrimental to their success in STEM. The lack of diversity in STEM fields, combined with a historical underrepresentation of women and minorities in these fields, can make it challenging for these students to find individuals who share similar backgrounds and experiences. This can lead to feelings of isolation and disconnection, which can significantly impact their interest and motivation to pursue STEM careers.

That role models can have a positive impact on the retention and success of women and minority students in STEM. When students have access to visible and relatable role models, they are more likely to persist in their studies and careers. Role models can provide valuable mentorship, advice, and support, helping students navigate the challenges and obstacles they may face along the way. They can also offer insights into how to overcome biases and stereotypes that may exist in the field and help students build the skills and networks necessary for success.

The lack of visible role models is a significant challenge facing women and minority students in STEM fields. Without relatable examples of successful individuals who share similar backgrounds and experiences, it can be challenging for these students to envision themselves succeeding in these fields. The absence of role models can also exacerbate imposter syndrome and lead to lower interest and participation in STEM fields. To address this issue, it is crucial to increase the visibility of successful individuals from diverse backgrounds and provide mentorship and support to young people pursuing STEM careers. By promoting greater diversity and inclusivity in STEM, we can unlock the full potential of the next generation of students and pave the way for a more equitable and innovative future.

### Educational Inequities

The issue of educational inequities is a critical factor that can hinder the progress and success of women and minority students in STEM fields. Unequal access to quality education and resources can limit opportunities and create significant barriers for these students, impacting their interest, participation, and success in STEM fields. For instance, students from lower-income backgrounds

may lack access to essential resources such as textbooks, technology, and laboratory equipment, which are critical for success in STEM fields. This can significantly impact their ability to excel in these fields, limiting their opportunities to pursue STEM careers.

Educational inequities can impact the quality of instruction and support available to women and minority students in STEM fields. Students from underrepresented backgrounds may face systemic biases and discrimination in the educational system, which can impact their academic performance and limit their opportunities. For instance, women and minority students may experience lower expectations from teachers, lower-quality instruction, and fewer opportunities for mentorship and networking.

The consequences of educational inequities can be far-reaching, impacting not only the academic and professional opportunities available to women and minority students but also the broader societal impact of a lack of diversity in STEM fields. A diverse STEM workforce is critical for innovation, creativity, and problem-solving, and a lack of diversity can limit progress and inhibit the development of new ideas and solutions. Therefore, addressing educational inequities and promoting greater access and opportunities for women and minority students in STEM fields is essential for creating a more equitable and innovative future.

Educational inequities can significantly impact the opportunities available to women and minority students in STEM fields, limiting their ability to excel and succeed. Addressing these inequities requires a comprehensive approach, including increasing access to quality education and resources, addressing systemic biases and discrimination, and promoting greater diversity and inclusivity in STEM fields. By investing in the success of underrepresented students in STEM, we can create a more equitable and innovative future for all.

### Cultural Factors

Cultural factors can significantly contribute to the underrepresentation of women and minority students in STEM fields, as they may face unique challenges and barriers that hinder their participation and advancement. One such factor is the societal norms and expectations embedded in certain cultures, which may discourage or limit women's access to STEM education and careers. In some cultures, traditional gender roles and stereotypes may prevail, where women are expected to conform to traditional feminine roles and not pursue careers in male-dominated fields like STEM. As a result, women may face pressure to prioritize family and household responsibilities over their career aspirations in STEM fields. Additionally, cultural beliefs and biases about the aptitude and abilities of women and minority students in STEM may also influence their access to opportunities, such as educational resources and mentorship. These cultural biases can perpetuate a perception that STEM fields are not suitable or desirable career paths for women and minority students, leading to lower representation in these fields. Furthermore, cultural factors can also impact the retention and advancement of women and minority students in STEM fields, as they may face discrimination, lack of support, and limited opportunities for career growth due to cultural biases and norms. Overall, addressing cultural factors that contribute to the underrepresentation of women and minority students in STEM fields is crucial for creating a more diverse and inclusive STEM workforce.

In addition to societal norms and expectations, cultural factors can also manifest in the form of limited representation and recognition of diverse cultures within the STEM field itself. STEM fields are often dominated by a Western-centric perspective, with Western contributions and



achievements being emphasized and prioritized over those from other cultural backgrounds. This Eurocentric bias can create a sense of exclusion and alienation for women and minority students who do not see their own cultural identities and experiences reflected in the STEM field, leading to a lack of motivation and interest in pursuing STEM careers. Cultural factors can also impact the availability of resources and opportunities for women and minority students in STEM fields. Some cultures may have limited access to quality STEM education or lack support systems, such as mentorship programs or networking opportunities, that are critical for career advancement in STEM fields. This can result in a significant disadvantage for women and minority students, limiting their ability to compete with their counterparts and excel in STEM careers.

Cultural stereotypes and biases may affect the perception of women and minority students' abilities in STEM fields. Deep-rooted biases, such as the belief that women or certain minority groups are not as capable or competent in STEM subjects, can create a hostile environment where women and minority students may face discrimination, bias, and prejudice from peers, teachers, or employers. This can create additional challenges and barriers, leading to lower representation and retention of women and minority students in STEM fields.

### Workplace Culture

Workplace culture within STEM fields can often be unwelcoming and exclusive, particularly for women and minority students. This can be attributed to several factors, including a lack of diversity among colleagues and leadership positions. In many STEM workplaces, women and minority students may find themselves in environments where they are underrepresented, and the lack of representation can make it challenging to feel included and valued. This lack of diversity can perpetuate a cycle where women and minority students may not see individuals who look like them or share similar backgrounds in leadership positions, leading to limited role models and mentors who can provide guidance and support.

Workplace culture in STEM fields may not always be supportive of work-life balance, which can disproportionately impact women and minority students. Traditional workplace cultures in STEM may prioritize long work hours, intense competition, and a lack of flexibility, which can create barriers for individuals with caregiving responsibilities or other personal commitments. This can disproportionately impact women and minority students who may face additional responsibilities and expectations outside of work, leading to challenges in managing their personal and professional lives.

Workplace culture in STEM fields may be characterized by subtle or overt biases, discrimination, and microaggressions. Women and minority students may face unconscious biases or discriminatory practices that can impact their career advancement, opportunities for growth, and overall sense of belonging. This can create a toxic and unwelcoming work environment, where women and minority students may feel unsupported, undervalued, and excluded. Workplace culture in STEM fields can also impact the opportunities for networking, mentorship, and professional development that are crucial for career advancement. In some cases, women and minority students may face barriers in accessing networks and mentorship opportunities due to exclusive networks that are formed based on shared backgrounds or interests. This can result in limited access to valuable resources and opportunities that can aid in career growth, such as access to funding, collaborations, or prestigious projects. Moreover, subtle biases or exclusionary practices may also

hinder women and minority students from fully participating in workplace activities or decision-making processes, further marginalizing their voices and contributions.

To create a more inclusive workplace culture in STEM fields, it is crucial to actively promote diversity, equity, and inclusion. This can be achieved by implementing policies and practices that foster inclusivity, such as diverse hiring practices, inclusive leadership training, and mentorship programs that prioritize diversity. Recognizing and celebrating the achievements of women and minority students through awards, promotions, and public recognition can also help in creating a more inclusive workplace culture. Additionally, promoting a positive work-life balance, providing flexibility in work arrangements, and addressing unconscious biases and discrimination through training and awareness programs can also contribute to an inclusive workplace culture in STEM fields.

Workplace culture plays a significant role in the underrepresentation of women and minority students in STEM fields. A lack of diversity, limited support for work-life balance, subtle biases, and exclusionary practices can create unwelcoming environments that hinder the advancement and inclusion of women and minority students in STEM careers. By actively promoting diversity, equity, and inclusion in the workplace culture, we can create a more inclusive and supportive environment where all individuals, regardless of their gender or background, can thrive and contribute to the advancement of STEM fields.

### Conclusion

The underrepresentation of women and minority students in STEM fields is a complex issue that requires attention from various stakeholders, including educators, policymakers, industry leaders, and communities. The factors that contribute to this issue, such as stereotypes and bias, lack of role models, educational inequities, cultural factors, and workplace culture, must be addressed to promote greater diversity and inclusivity in STEM fields.

Stereotypes and bias can manifest in subtle ways, such as assumptions about ability or interest, and can limit opportunities for students from these groups. Addressing these biases requires a concerted effort to challenge stereotypes and promote greater awareness and education about the value of diversity in STEM fields. Without visible role models to look up to, students from these groups may struggle to envision themselves succeeding in these fields, leading to lower interest and participation. Efforts to increase the visibility of successful women and minority STEM professionals can help address this issue and provide inspiration and motivation for the next generation of STEM leaders.

Educational inequities, such as unequal access to quality education and resources, can limit the opportunities available to women and minority students in STEM fields. Students from lower-income backgrounds may not have access to the same resources as their peers, which can limit their ability to excel in STEM fields. Addressing these educational inequities requires greater investment in STEM education and resources, as well as policies that promote greater equity in education. Some cultures may not encourage women to pursue careers in STEM fields or may not view these fields as desirable career paths. Addressing these cultural factors requires a comprehensive approach that involves promoting greater diversity and inclusivity in STEM fields, challenging stereotypes and biases, and creating supportive and inclusive environments for all students. Workplace culture in STEM fields can be unwelcoming to women and minority students, which can lead to feelings of exclusion and a lack of belonging. This can include things like a lack of diversity among colleagues and leadership, as well as a lack of support for work-life balance. Addressing these workplace culture issues requires a concerted effort from industry leaders to create more inclusive and supportive environments that value diversity and promote work-life balance.

Addressing the underrepresentation of women and minority students in STEM fields requires a multifaceted approach that involves addressing the various factors that contribute to this issue. By promoting greater diversity and inclusivity in STEM fields, challenging stereotypes and biases, increasing access to quality education and resources, addressing cultural factors, and creating more inclusive workplace cultures, we can help ensure that all students have the opportunity to excel and succeed in STEM fields. Doing so will not only benefit individuals and communities, but also contribute to a more innovative and equitable society.

## References

- [1] S. M. Jackson, A. L. Hillard, and T. R. Schneider, "Using implicit bias training to improve attitudes toward women in STEM," *Soc. Psychol. Educ.*, vol. 17, no. 3, pp. 419–438, Sep. 2014.
- [2] A. García-Holgado, S. Verdugo-Castro, M. C. Sánchez-Gómez, and F. J. García-Peñalvo, "Facilitating Access to the Role Models of Women in STEM: W-STEM Mobile App," in *Learning and Collaboration Technologies. Designing, Developing and Deploying Learning Experiences*, 2020, pp. 466–476.
- [3] R. Noonan, "Women in STEM: 2017 Update. ESA issue brief #06-17," *US Department of Commerce*, Nov. 2017.
- [4] J. Saucerman and K. Vasquez, "Psychological barriers to STEM participation for women over the course of development," *Adulthoodspan J.*, vol. 13, no. 1, pp. 46–64, Apr. 2014.
- [5] A. H. Eagly and V. J. Steffen, "Gender stereotypes stem from the distribution of women and men into social roles," *J. Pers. Soc. Psychol.*, vol. 46, no. 4, pp. 735–754, Apr. 1984.
- [6] A. L. Griffith, "Persistence of women and minorities in STEM field majors: Is it the school that matters?," *Econ. Educ. Rev.*, vol. 29, no. 6, pp. 911–922, Dec. 2010.
- [7] X. Jiang, "Women in STEM: Ability, preference, and value," *Labour Econ.*, vol. 70, p. 101991, Jun. 2021.
- [8] F. J. García-Peñalvo, "Innovative Teaching Approaches to attract, engage, and maintain women in STEM: W-STEM project," Nov. 2019.
- [9] L. R. Ramsey, D. E. Betz, and D. Sekaquaptewa, "The effects of an academic environment intervention on science identification among women in STEM," *Soc. Psychol. Educ.*, vol. 16, no. 3, pp. 377–397, Sep. 2013.
- [10] A. B. Diekmann, E. S. Weisgram, and A. L. Belanger, "New routes to recruiting and retaining women in STEM: Policy implications of a communal goal congruity perspective," *Soc. Issues Policy Rev.*, vol. 9, no. 1, pp. 52–88, Jan. 2015.
- [11] R. J. Burke, "Women and minorities in STEM: A primer," *Women and minorities in science, technology*, 2007.
- [12] F. J. García-Peñalvo, "Women and STEM disciplines in Latin America: The W-STEM European Project," *J. Inf. Technol. Res.*, Sep. 2019.
- [13] E. O. McGee and L. Bentley, "The Troubled Success of Black Women in STEM," *Cogn. Instr.*, vol. 35, no. 4, pp. 265–289, Oct. 2017.
- [14] A. García-Holgado, A. C. Díaz, and F. J. García-Peñalvo, "Engaging women into STEM in Latin America: W-STEM project," in *Proceedings of the Seventh International Conference on Technological Ecosystems for Enhancing Multiculturality*, León, Spain, 2019, pp. 232–239.
- [15] C. A. Shapiro and L. J. Sax, "Major selection and persistence for women in STEM," *New Dir. Inst. Res.*, vol. 2011, no. 152, pp. 5–18, Dec. 2011.
- [16] N. N. Heilbronner, "The STEM Pathway for Women: What Has Changed?," *Gift. Child Q.*, vol. 57, no. 1, pp. 39–55, Jan. 2013.
- [17] S. Kahn and D. Ginther, "Women and STEM," 2017.



- [18] B. Bloodhart, M. M. Balgopal, A. M. A. Casper, L. B. Sample McMeeking, and E. V. Fischer, "Outperforming yet undervalued: Undergraduate women in STEM," *PLoS One*, vol. 15, no. 6, p. e0234685, Jun. 2020.
- [19] H. Blackburn, "The Status of Women in STEM in Higher Education: A Review of the Literature 2007–2017," *Science & Technology Libraries*, vol. 36, no. 3, pp. 235–273, Jul. 2017.