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Women of Color are Underrepresented in American STEM Undergraduate Programs

In the United States, women are currently pursuing higher education at a greater rate compared to previous generations, as data and various studies have indicated that there are more female students at undergraduate institutions in contrast to their male peers. The problem with this new development however is that though more women are enrolled as students, only a small percentage choose to study a STEM discipline leading to an underrepresentation of women in undergraduate science programs. Though “women outnumber men in college enrollments ... they remain severely underrepresented in terms of undergraduate degree attainment in critical areas of study (such as STEM) in comparison to their male peers” (Gayles and Ampaw 439). Thus, a huge issue that is persistent at the undergraduate level is the gender division of educational fields because science studies are heavily male-dominated despite efforts to promote women in STEM disciplines such as computer science and physics. Essentially, a major issue that the United States government has been unable to truly solve is the manifestation of cultural norms that masculinize STEM fields leading to women being excluded from these fields and later jobs related to these departments at an extremely disproportionate rate. Despite many young girls displaying an interest in the sciences, the likelihood of them continuing to focus on STEM during their higher education is considerably lower. Thus, the pathway from girls displaying a passion for the sciences in secondary or even high school leading to a future career path in the same field is not sustainable or realistic considering how young women face numerous barriers when choosing to continue their STEM studies due to discriminatory factors such as sexism, racism, and classism. So, in order to combat the numerous prejudices that seep into the undergraduate level, the American government should address how these ideologies lead to women being denied entry into these emerging and highly competitive fields due to the issues present across the entire educational system. The underrepresentation of women of color at the undergraduate level in STEM majors is an issue that needs to be addressed because it directly feeds into the lack of diversity present in the job market in various technological fields as well as how increasingly important these disciplines are in a world that highly prioritizes digital innovation and profits off of innovation in which women are not able to contribute towards as much as their male peers.

The gendered nature of educational fields has always been prominent, as patriarchal narratives associate women with studies or teachings that prepare them for jobs in the domestic sphere. For example, “during the early 1960s, women were concentrated in an extremely limited range of fields,” as “over 70% of women graduates were concentrated in just six fields: education, English, fine arts, nursing, history, and home economics” (Jacobs 168). Women were encouraged to work as teachers or nurses, which were both jobs

considered traditionally feminine according to universal gender norms thus explaining the high rates of enrollment for women in these educational departments that would then support their future job upon graduation. On the other hand, “Disciplinary norms dictate that scientists be decisive, methodical, objective, unemotional, competitive, and assertive—characteristics often associated with men and masculinity (Bielby 1991; Etzkowitz, Kemelgor, and Uzzi 2000; Kvande 1999; Martin 2001, 2003; Miller 2004; McIlwee and Robinson 1992; Ong 2005; Turner 2002)” (Rhoton 698). Patriarchal values, which associate men with rationality, were embedded into institutions including the education system and the labor market for decades, which is manifested in the persistent gendered division of schooling that has led to the modern-day underrepresentation of women in STEM fields as these departments grew more relevant along with the rise of the digital age in America. Though the narrative associating STEM with masculinity has been slowly dismantled as women’s rights improved and patriarchal attitudes were questioned, the issue still remains today despite many movements encouraging women and other minorities to study STEM to some but not enough success. Feminist movements have played a large role in addressing the harmful effects of gender norms, which are manifested in everyday life including how incoming undergraduate students may gravitate towards a specific discipline due to a preconceived notion of who should study what without criticizing the system that indirectly influences their choices.

Though historical notions of gendered educational fields play a large role in people’s mindsets that lead to the underrepresentation of women in STEM fields, another large aspect is the social setting that female students experience within the classroom or departmental setting that impacts the rest of their undergraduate experience. For example, the researchers “Vogt, Hovevar, and Hagedorn (2007) found that female students in science-related majors reported higher levels of perceived discrimination, effort, and help-seeking behaviors compared to male students” (Gayles and Ampaw 444). Essentially, the culture that arose as a result of STEM being a male-dominated field has led to the female students, who are enrolled in that department, being isolated from their peers as well as that leading to a tendency of justifying the toxic environment that those interactions create by blaming themselves for the harshness they experience from their male peers. In fact, “Powell, Bagilhole, and Dainty (2009) found that women undergraduates who have experienced gender discrimination try to justify the actions of their work colleagues, framing the discrimination as unintentional or believing that the consequences are ‘good for them’” (Rhoton 699). In actuality, this isolation leads to an increased discouragement of women to participate in STEM studies due to the realization that the likelihood of them being isolated and needing to put in more effort for the same experiences their peers have is far greater than what should be the norm. Thus, the departmental culture creates an environment in which women are discouraged from speaking up or discussing the blatant discrimination they face from both professors as well as other students. In order to target the sexist culture within the STEM department itself, solutions should target students and faculty on an individual level versus the societal level change, which is required to dismantle patriarchal attitudes as discussed before. The impact of a professor in a classroom setting can play a huge role in addressing the toxic culture within the department itself, as “Alexander and Hermann (2016) noted that educators, particularly at the higher education level, should receive training on cultural responsiveness and effective

mentoring processes” to “ensure that learning environments are shaped in a way that leverage identity as a cultural asset with cultural integrity (see Boykin, 2010) in STEM education” (Ireland et al. 247). Thus, a professor who is able to recognize when a female student is being isolated or facing difficulty, they can then diffuse any hostile situation as hand and provide assistance along with educating male students who partake in this toxic behavior. In fact, “female students in science majors benefited more than their male counterparts from interacting with faculty outside of the classroom” due to male peers dismissing women in their department, so the mentorship found between the professors and female students “should be encouraged particularly in STEM fields of study” (Gayles and Ampaw 463). In summary, the campus environment at an undergraduate level is particularly important to the issue at hand because the majority of undergraduate students live on campus, and thus the interactions female students in STEM have with their professors and peers are extremely important to their decision on whether to continue their education in science. Thus, cultural sensitivity and the emphasis placed on mentorship as a form of mental support should be mandated in undergraduate institutions in order to address the issue on an individual level.

While the experiences of female undergraduate students have oftentimes been generalized as one that is universal, the reality is that factors such as race and class have an equally important role in excluding marginalized women from movements and initiatives that seek to promote women in STEM. As Ireland et al. state, “education research and practice efforts to address diversity issues in STEM have failed to adequately contend with the ways U.S. institutions have historically marginalized students of color while educationally privileging both whiteness and maleness (Collins & Bilge, 2016; Ladson-Billings & Tate, 1995)” (Ireland et al. 227). The concept of intersectionality is fundamental to understanding the issues that women of color face as well as lower-income female students in regard to the undergraduate experience in the United States. For example, Gayles and Ampaw found that “low-income female students were more likely to attend part-time and work more hours,” which impacts the amount of time they could set aside for school along with the reality of student debt due to high tuition fees leading to situations in which leaving school would be a better option for many lower-income female students due to extenuating circumstances (Gayles and Ampaw 464). As Gayles and Ampaw discuss, policies such as “financial aid, scholarships, and other forms of financial assistance that offset the cost of higher education expenses” are vital to supporting lower-income female students especially because they already experience marginalization based on their gender along with additional challenges when continuing their studies due to their financial situation (Gayles and Ampaw 464). When discussing the role income inequality plays in discouraging women from entering STEM fields, it is important to recognize how studies have also found that “Having highly educated parents has been linked to high levels of parental encouragement, which, in turn, has been found to impact entry and persistence in the sciences for women (Astin & Sax, 1996; Huang, Taddese, & Walter, 2000; Maple & Stage, 1991; Rayman & Brett, 1995)” (Gayles and Ampaw 443). If a female student’s parent is already working within the STEM field, then the likelihood of them continuing to pursue a STEM major is increased exponentially due to the positive correlation between income levels and their parent's employment status which is dependent on their level of education. Thus, first-generation college students, whose parents did not attend an undergraduate institution, are heavily disadvantaged from pursuing STEM

considering how their peers whose parents pursued a higher education are able to guide them through the intensive process of choosing the right classes for example along with navigating the often confusing curriculum at hand. Essentially, there are not enough resources available to fill in the gap of knowledge on how to best absorb the rigorous and highly competitive science major departmental insights because of the overarching premise that the majority of the students enrolled come from a legacy or background in which they are already familiar with the nuances of the curriculum or future career opportunities. Considering that, first generation female students, who often come from a low-income background, as well as second-generation female immigrants, who are often women of color, are forced to reconcile with an environment that is designed to isolate them considering the numerous additional struggles that they experience when they continue their studies in the sciences. Also, considering the amount of workload and the need to spend extra time outside of the classroom within these curricula, students who need to work alongside their studies are also at a disadvantage once again emphasizing the importance of addressing the inherently classist component of the underrepresentation of marginalized women in STEM. Jacobs says that “Gender inequality in earnings persists despite rough equality in access to education, whereas class inequality is based on sharp differences in access to education,” which is an interesting insight into the intersectional nature of the underrepresentation of marginalized groups in STEM undergraduate programs considering that the systems: classism and racism are heavily intertwined and uphold one other in social and highly politicized institutions such as education and the labor market (Jacobs 160). Essentially, while women are able to access education, the issue is recognizing the difficulty for them to continue to thrive throughout their experience due to barriers such as classism and racism, which continue to further discourage marginalized women in particular as they do not have access to the privileges of their peers who are able to navigate STEM spaces far easier unfortunately. Though wealthier female students along with those whose parents are highly educated, which as discussed earlier are linked to issues of class as well as race, may benefit from efforts to promote women in STEM, there needs to be a thorough examination of how many of these movements continue to alienate other marginalized women thus contributing further to the lack of diversity in undergraduate STEM programs across the United States.

Though briefly discussed earlier, I wanted to specifically address the racist and sexist ideologies that target women of color during their undergraduate experiences. While various programs are intended to increase the percentage of women in STEM, a recurring theme is that women of color are consistently left behind and continue to be underrepresented at the undergraduate level. The respective phenomenon “The *double bind* refers to the exclusion of women of color in STEM and the undermining of their career pursuits because of both racism and sexism” (Ireland et al. 228). As previously discussed, income level and gender are connected under an intersectional lens similar to how race and gender continue to impact and shape one another. The prominent image associated with STEM disciplines is one that upholds or glorifies white and masculine characteristics as discussed by Ireland et al., which continues to discourage women of color in particular starting from earlier ages to see themselves represented in the field. In my opinion, there needs to be a push towards implementing more women of color as mentors and professors in American STEM university departments because many marginalized female students may not feel comfortable enough to

come to their professors, who are either white or male, fearing that their worries and experiences will be invalidated. Rather, women of color should be able to see themselves as potential scientists working towards learning alongside their peers without the fear of being excluded or isolated. As discussed before, many women benefit from spending time outside of the classroom with their professors, so having women of color in these positions will help marginalized students feel accepted and more comfortable asking for help so that they do not fall behind compared to their peers and have the same experiences as well.

A great program that could address the gap in knowledge between privileged students and marginalized students, including lower-income female students as well as women of color, that should be studied is the Break Through Tech initiative that the American college CUNY has implemented to great success. The CUNY administration recognized that “Many CUNY students begin college without awareness of career options in tech, nevermind coding experience,” which “prevents them from pursuing computer science degrees and makes it harder for them to get internships in tech-related fields, as they lack the real-world experience—coding camps, hackathons—that many companies require of internship candidates” (Amandolare 32). One of the major issues regarding the underrepresentation of women in STEM has always been the high barrier to entry within the working and education field, as many female students wish to enroll in science classes despite having no prior experiences as such; however, many of their peers have already learned coding skills and other vital background knowledge related to the field starting from high school or even earlier. Consequently, lower-income students and women of color particularly face the brunt of this high barrier of entry during the transition from high school to college, as coding or other science classes are not necessarily available across the majority of American high schools, let alone extracurricular courses in those topics. Thus, students with a greater level of privilege, who do have access to these coding classes prior to entering college, are more likely to be accepted into internships and other jobs that would place them in a more advantaged position compared to their peers, who would feel discouraged and thus be at a higher risk of dropping out of their STEM major or falling behind in their classes. In fact, according to the CUNY program, “Break Through Tech targets these students, who often lack the time for tech-related extracurriculars because they work alongside their studies” (Amandolare 32). So, I believe that the government should implement a similar program nationwide in both private and public undergraduate institutions to allow for students, who choose to start their STEM studies when they enter college without any prior knowledge or experience, which would then particularly benefit women who are so often discouraged and disconnected from STEM at earlier ages as the issue technically starts even before the undergraduate level. Including policies to ensure that female professors, particularly women of color, are in every STEM collegiate department along with addressing the financial constraints many female students face would strive to mend the disproportionate underrepresentation of women in STEM at the undergraduate level.

Another solution that the government should address is dismantling the societal norm associating STEM with men considering how gendered notions of the discipline students should focus on heavily impacts the demographic and community of every undergraduate department. Thus, I think that the government should encourage young girls to see themselves represented as scientists at an earlier age, as the issue of underrepresented women

in STEM is not an issue found in a vacuum but rather one that gradually becomes more noticeable as students get older. For example, during elementary school there are more girls interested in STEM compared to the number present during high school and even later during college. Thus, “Learning opportunities that enhance early exposure to science can be instrumental in fostering a science identity for young girls by creating opportunities to see oneself as a ‘scientist’ (Riedinger & Taylor, 2016)” (Ireland et al. 234). Ireland et al. discuss how “At the elementary and secondary levels, there is a greater focus on cultivating a STEM identity through conceptual understanding and exposure to STEM-related activities (e.g., Buck, Cook, Quigley, Eastwood, & Lucas, 2009; Scott & White, 2013), whereas studies at the collegiate level tend to explore barriers to maintaining STEM identity development (Carlone & Johnson, 2007)” (Ireland et al. 234). Currently, young girls feel disconnected from this notion of a STEM identity, which grows stronger with time, as if they do decide to enroll in the sciences at a later age there are a multitude of barriers to re-entering that field. So, in order to address the issue at the undergraduate level, there needs to be a focused effort to dismantle patriarchal, racist, and classist attitudes that continue to associate STEM with both whiteness and masculinity along with policies encouraging women of color especially to play a large part in uplifting the voices of marginalized voices along with ensuring that the representation in the faculty department will be reflected among the student base as well. Overall, there needs to be more programs to smoothen the transition period many women face as they should be encouraged to reconnect with their STEM interests nationwide by reducing barriers to entry including the gap of knowledge along with financial constraints and a fear of being marginalizing in order to succeed in addressing the issue at hand considering the potential positive influence that governmental action could have on addressing and solving this particular issue.

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