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THE STEM GENDER GAP: A LITERATURE REVIEW OF ISSUES, CAUSES, CONSEQUENCES, AND SOLUTIONS

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Abstract

Science, technology, engineering, and mathematics (STEM) is vital for any advancing society. While diversity in STEM has improved significantly over the years, there is still evidence that gender inequality persists. The lack of diversity regarding gender is often referred to as the STEM gender gap. To delve deeper into this topic, the information presented in this literature review discusses the issues, causes, consequences, and solutions of the STEM gender gap.

Key words: STEM gender gap, literature review, science, technology, engineering, mathematics, STEM, diversity, gender inequality persists

STEM is an acronym used for Science, Technology, Engineering, and Mathematics. The STEM gender gap consists of various factors that deter women from pursuing STEM fields, which results in a higher concentration of males pursuing STEM than females. The gender gap has been a controversial issue for years and many individuals (both experts and non-experts) have expressed their opinions and conducted research on this matter. While some say that gender stereotypes are the cause of this gender gap, others believe that peer influence is the reason for the gaps between men and women. In either regard, the issues and causes of the gender gap result in disadvantageous consequences (for girls and women) but opens the discussion for solutions to address the disparities. The sources listed in this literature

review discuss the STEM gender gap and how it affects women/girls, the causes (like gender stereotypes, cultural ideologies, and peer influences), the consequences (such as lower pay), and the solutions (such as more female role models in STEM).

Issues

The sources find that the STEM gender gap poses many issues to girls and women globally. The typical stance on this issue is that there are not enough women in STEM. McDaniel writes that, Women's underrepresentation in science, technology, engineering, and math (STEM) fields is a continuing concern for those who are either involved or make decisions in these fields like scholars, educators, and policymakers. (McDaniel, 2016, p. 122). Moè explained, "disproportionately few women decide to study or work in science, technology, engineering, and mathematics (STEM) fields." (qtd in National Science Foundation 2018). Opposing views have identified that peer influence is a major factor of the STEM gender gap: Females that are exposed to other female peers earn less, have more children, and usually do not pursue STEM fields. (Brenøe & Zölit, 2020, p. 1013). Additionally, some believe that when there are more females present in classrooms, less females will pursue STEM because of the strong social influence. Raabe, 2019, et al. believe girls that do not have STEM as their favorite subjects will cause more girls to dislike STEM.

Causes

Scholars, students, advocates, and researchers have evaluated the STEM gender gap and the main causes of this issue. Some of the typical conclusions that individuals make about this gender gap gender stereotypes and cultural ideologies. According to McDaniel, "[gender] segregation research maintains that gender-essentialist ideologies, or the notion that men and women have different aptitudes and abilities, explain why women have failed to reach parity with men in STEM

fields.” (McDaniel, 2016, p. 124). Additionally, gender stereotypes affect boys and girls differently. Gender socialization theory implies that girls and boys internalize gender ideologies. (McDaniel, 2016, p. 124). Aside from gender norms, other articles believe that the differences in cognitive abilities and anxiety are the causes behind the STEM gender gap. According to Jungert, “E-S theory is built upon the notion that the human brain has evolved to sustain our species by adapting to an ever-changing environment that contains two different components: the physical world, governed by what we might term mechanical laws, and the social world” (Jungert, et al., 2019, para. 4). Therefore, this theory implies that there are sex differences in cognitive style showing males are likely to be higher in systemizing than females, and females are likely to be higher in empathizing.” (Jungert, et al., 2019, para. 5). Researchers that have utilized E-S Theory obtained results that imply that students that pursue STEM careers are higher in systemizing and lower in empathizing. (Jungert, et al., 2019, para. 5).

While some articles express that differences in cognitive style are the causes of the gender gap, other authors explain that anxiety and mental rotation are the underlying factors. Males usually have greater ability to utilize mental rotation more quickly and accurately than women. (Moè, et al., 2021, p. 555). Students can experience a variety of emotions when it comes to education. (Jungert, et al., 2019, para. 16). Girls are more likely to experience anxiety than boys when it comes to concepts that involve mathematical reasoning. (Jungert, et al., 2019, para. 16). Sometimes, anxiety and mental and cognitive abilities are not the only reasons behind the gender gap, but influence from other females. “Girls, having lower probabilities to like STEM already, are likely further influenced by other girls, who are also less likely to prefer STEM,” as Raabe, et al. states. (2019, p. 119). Hence, this could lead to further consequences if this gender deterrence from STEM remains unaddressed.

Consequences

If the STEM gender gap is not resolved, there could be serious consequences in the long run. According to Brenøe & Zölitz, “Not only are women who are exposed to more female high school peers less likely to choose STEM studies, they are also less likely to work in STEM occupations, and they have lower earnings at age 36.” (Brenøe & Zölitz, 2020, p. 1012). Female peer influence lessens the rate that females enter STEM fields by 4%, therefore, increasing the gender wage gap by 5%. (Brenøe & Zölitz, 2020, p. 1012). As mentioned earlier, gender stereotypes are one of the causes of the gender gap. Since these stereotypes are embedded in cultures all around the world, there tends to be more male than female role models in STEM. Males in STEM who continue to endorse male role models reinforce the gender stereotype that men have better rotation skills than women. This could lead people to believe that females lack the mental ability to succeed in STEM studies/careers. (Moè, et al., 2021, p.564).

Solutions

Even though there are many factors that deter girls and women from pursuing STEM, there are solutions to address this problem. One example includes “having other female students in a class who prefer STEM can protect girls from being discouraged from STEM subjects,” according to Raabe, et al. (2019, p. 119). Moreover, if society believes that women can excel in STEM, then more women will pursue STEM fields. If more people believe that females can excel in “male-oriented” fields, then more will be encouraged to pursue STEM. (Moè, et al., 2021 p. 564). In fact, to get even more females to pursue STEM, there must be more female role models in these fields. According to Jungert, “... it is important to provide female students with more female role models to increase positive attitudes towards STEM...and encourage female students to aspire towards STEM careers.” (Jungert, et al, 2019, para. 46). A greater number of female role models would introduce girls

to STEM as early as elementary school and create positive images of females in STEM. (Jungert, et al, 2019, para. 46).

Conclusion

In conclusion, the STEM gender gap describes the low numbers of women that work in STEM fields. The issue has prevailed for years, and there are several viewpoints as to why the gender gap still exists. This literature review utilized five articles that explain the consequences of the STEM gender gap. Factors like peer influence and gender stereotypes cause the gender gap which leads to wage gaps and females avoiding STEM fields. The solutions to this problem involve highlighting more female role models and having more girls in classroom that are interested in STEM (so they can influence their fellow female peers). ■

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