Gender Disparities in STEM Fields: Inspiring Women to Find their Voice

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Introduction

Statement of the Phenomenon

In the 20th century, women were disproportionately underrepresented in most STEM fields when compared to men. According to analyses by the PEW Research Center, gender disparities in specific domains within STEM fields (e.g., life sciences, mathematics) have significantly decreased over the past 25 years, while others remain quite large (e.g., computer science, engineering). The question that inevitably rises is why?

The purpose of this study is to synthesize peer-reviewed research from developmental and social psychology to identify variables that help explain why these disparities exist.

The research suggests several variables that contribute to women's interest in STEM. During adolescence it was shown that self-efficacy, motivational strivings, socioeconomic status, and familial values play a significant role in the development of girls' interest in STEM. There are also societal and social context variables, such as cultural views, stereotypes, and stereotype threat, that make understanding gender disparities a complex issue.

Research Question

- What are the underlying factors that contribute to gender disparities in STEM fields?

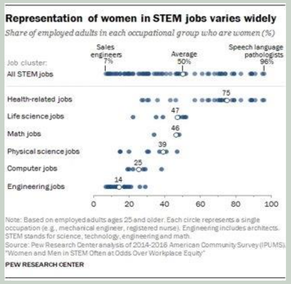
Method

Procedure

Analyzed and assessed 21 scientific papers concerning the nature of gender disparities in STEM fields

Gender Disparities in STEM

Figure 1. This figure represents the percentage of women that are represented within specific domains within STEM fields (Funk & Parker, 2019)



Evidence

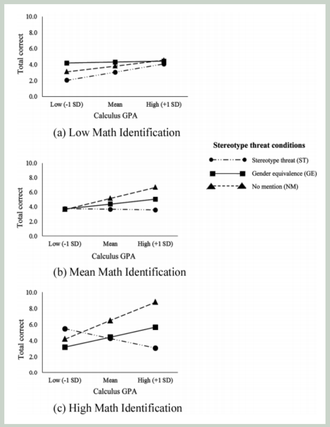
Factors that Influence STEM Enrollment for Females

- Expectancy value theory states that when strengthening an individual's interest in one academic domain, it tends to weaken that individuals performance in another academic domain (e.g. If one supports english and history, an individual may feel that they do poorly in math and science).
- Countries with higher levels of gender egalitarianism, showed higher national sex differences within mathematics anxiety (Figure 3)
- The higher the socio-economic status, the greater the likelihood of STEM enrollment
- Overall math test performance in single sex (middle and high) schools was better than performance in co-educational schools.
- Goal congruity perspective is/states that certain goals are repeatedly endorsed or situationally activated
  - Goal Affordance Stereotypes
    - Individuals who highly endorsed communal goals were less likely to go to STEM fields
- A meta-analysis study concerning thing-person orientation has shown that on average women tended to be more people orientated while men tended to be more thing orientated
  - <u>However</u> it should be noted that despite certain gender predispositions women who were more thing orientated were also more likely to go into STEM fields, and men who were more people orientated reported to be uninterested in STEM fields.
- When compared to European American women, African American women held a weaker implicit stereotype threat, which in turn resulted in the greater likelihood of African American women participation in STEM compared to European American women.
- **All of these factors explain reasons as to why gender disparities exist today in STEM.**

Stereotype Threat

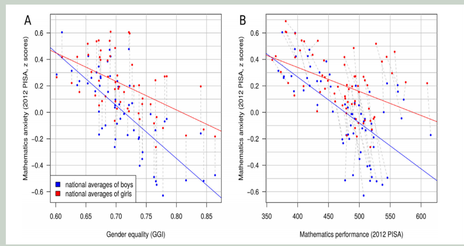
- Stereotype Threat is a state of psychological discomfort that can impede an individual's performance when exposed to a negative stereotype
- Women who had the highest math identification were more likely to be affected by stereotype threat

Figure 2. This figure represents a factorial design between math identification, stereotype threat, and the amount of questions that are correctly answered. It shows the effects of stereotype threat in academic performance in women (Steinberg, Okun, & Aiken, 2012)



Mathematics Anxiety

Figure 3. These two graphs represent the relationship of mathematics anxiety with gender equality and mathematics performance. Countries with higher levels of gender equality show larger national sex differences in mathematics anxiety and relatively lower parental mathematics valuation for girls.



Discussion

Stereotype threat, expectancy value theory, socio-economic status, single sex schooling, cultural values and many more factors are involved when attempting to address the issue of gender disparity. In short this is a multi-variable problem.

Culturally the evidence shows that African American women were more likely to enroll into STEM fields than European American women. This may speak to a sort of cultural barrier that people of different ethnicities face.

Socio-economic status has always been an issue in our society because people who may come from lower economic statues are generally more likely to be part of the dispossessed. We should place policies in place to encourage economic mobility in order to combat this. This doesn't speak to improve a gender disparities in STEM fields but to also improve our economic system as a whole.

We should do our best to alleviate gender disparities in STEM in the most natural way possible. As the evidence has shown, countries with higher levels of egalitarianism still had higher national sex differences between men and women. This poses as a problem when attempting to address gender disparities in STEM fields because it turns out it isn't as easy as we thought. On a large societal scale, we do not know of the potential ramifications of attempting to address this phenomenon by simply equalizing (creating a quota system) the academic domains.

A meta-analysis on people and thing orientation has shown that by in large, women are more people orientated while men tend to be more thing orientated. This is presented so that it isn't an issue, but a phenomenon that should be taken into account when analyzing gender disparities in STEM fields.

Implications

This project can help individuals attain the knowledge necessary to analyze and assess future potential solutions in alleviating gender disparities in STEM fields.

Limitations

The limitations of this study mirror the limitations of the published studies used. However, many of the academic studies have already been replicated previously and have been exposed to the scientific community for further examination.

Future Directions

The majority of the scientific articles have concluded that by promoting programs that are more inclusive to girls, this would result in the most pragmatic and best solution to alleviating gender disparities in STEM fields.

References

1.Appel, M., Kronberger, N., & Aronson, J. (2011). Stereotype threat impairs ability building: Effects on test preparation among women in science and technology. *European Journal of. Social Psychology, 41*(7), 904–913.
2.Cherney, I., & Campbell, K. (2011). A league of their own: Do single-sex schools increase girls' participation in the physical sciences? *Sex Roles, 65*(9–10), 712–724.
3.Diekman, A. B., Clark, E. K., Johnston, A. M., Brown, E. R., & Steinberg, M. (2011). Malleability in communal goals and beliefs influences attraction to stem careers: Evidence for a goal congruity perspective. *Journal of Personality and Social Psychology, 101*(5), 902–918.
5.Funk, C., & Parker, K. (2019, December 31). Women and Men in STEM Often at Odds Over Workplace Equity. Retrieved from https://www.pewsocialtrends.org/2018/01/09/women-and-men-in-stem-often-at-odds-over-workplace-equity/
4.O'Brien, L. T., Blodorn, A., Adams, G., Garcia, D. M., & Hammer, E. (2015). Ethnic variation in gender-STEM stereotypes and STEM participation: An intersectional approach. *Cultural Diversity & Ethnic Minority Psychology, 21*(2), 169–180.
5.Stoet, G., Bailey, D. H., Moore, A. M., & Geary, D. C. (2016). Countries with higher levels of gender equality show larger national sex differences in mathematics anxiety and relatively lower parental mathematics valuation for girls. *PLoS ONE, 11*(4), 1–24.
6.Steinberg, J., Okun, M., & Aiken, L. (2012). Calculus GPA and math identification as moderators of stereotype threat in highly persistent women. *Basic & Applied Social Psychology, 34*(6), 534–543.
7.Graziano, W., Habashi, M., Evangelou, D., & Ngambeki, I. (2012). Orientations and motivations: Are you a "people person," a "thing person," or both? *Motivation & Emotion, 36*(4), 465–477.
8.Kerr, & Robinson Kurpius, S. E. (2004). Encouraging talented girls in math and science: effects of a guidance intervention. *High Ability Studies, 15*(1), 85–102.
9.Lauermann, F., Yi-Miau Tsai, & Eccles, J. S. (2017). Math-related career aspirations and choices within eccles et al.'s expectancy-value theory of achievement-related behaviors. *Developmental Psychology, 53*(8), 1540–1559.
10.LIAN NIU. (2017). Family socioeconomic status and choice of stem major in college: An analysis of a national sample. *College Student Journal, 51*(2), 298–312.