

Position Paper #1: Women in STEM

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Why do we care about the lack of women in math-intensive fields (STEM, or science, mathematics, engineering, computer science, and other related fields)? Women should have the same opportunities as men in these fields. Studies have shown that women are just as capable as men in math-intensive STEM fields and therefore they shouldn't be statistically underrepresented unless there is some underlying cause.

What that underlying cause happens to be is subject to much debate. There is significant evidence that there is a fundamental difference between the male and female brain. This difference is usually manifest in spatial abilities and reasoning, men having the advantage. However, there is further evidence that even though men have stronger spatial processing this does not reflect on overall mathematical ability. Hyde, Fennema, and Lamon show in their 1990 meta-study of mathematics test scores that women and mens scores are close with only a slight difference between the two sexes. This small statistical difference alone cannot account for the huge gender gap in STEM careers.

If there is conflicting evidence that gross physical differences aren't sufficient enough to cause the large gender gaps seen in STEM fields, what then is the cause (Ceci, Williams)? I propose that it is a combination of a number of subtle sociological, educational, and cultural factors which causes the significant gap.

Perception of traditional gender roles are a primary contributor. Classically, women are the second-class when it comes to careers and advancement outside of the home. The man is the breadwinner for the family. More and more women do have a life outside of the home but women are generally expected to take inferior careers like general office work or to do "soft" things like education or social work or nursing. Most of the careers expected of them allow them to continue in their traditional home roles while fulfilling the modern expectation of them outside of the home.

These gender perceptions are transmitted throughout our society. From childhood, there is significant gender role imprinting. Toys, movies, music, books all promote women who generally aren't in STEM careers and rather are in something else. Those women who are in STEM careers usually aren't at the top of their field or don't excel based on academic merit. A good example of this is Christmas Jones from the James Bond film *The World Is Not Enough*. Here we have a nuclear scientist who is also a beautiful young lady. Instead of being a scientist she is a damsel in distress needing a man to save her. She should be an expert in her field, yet the non-expert James Bond knows as much as her.

There are countless other examples of gender perception in popular media, however, they aren't, strictly, the most insidious carrier. Childrens toys more than anything are biased against girls when it comes to STEM later in life. Most girls toys are designed around playing house or playing doctor or acting in a service capacity. Toys which build critical thinking skills, like Lego or Erector, aren't targeted at girls. Rather they're targeted at boys.

Now, to defend the toy makers, they market to the segments which buy their toys, so they can't be held solely responsible for targeting boys and girls for different types of products. The people who buy those products are to blame. Girls get girly things and boys get boyish things. Why can't a girl enjoy playing with Lego?

Because this gender stereotyping is integrated into our social norms, it's difficult to both identify its influence and to change it. Girls grow up thinking that they should and are

expected to go into those stereotypical careers. Even when they show a proficiency in math and science, if they are steered into STEM careers they are softer, such as psychology, medicine, and biology, which are more acceptable in society for women.

If girls do pursue a math intensive STEM career, they are more likely to drop out of it due to social pressures as well. Women are expected to be the mothers and home-maker. STEM careers, in general, require a higher amount of dedication, which in turn lessens the woman's ability to be mother and home-maker. This causes a woman to make the determination between looking poor in society's eyes (by putting career over family) or reducing or removing the implications that their career places on their lives.

There are also negative social pressures internally in the STEM fields. In the area of computer science, there can be significant gender imbalances. Many undergraduate programs can have a male-to-female ratio in excess of 20-to-1. This creates a hostile environment to any women who may be interested in the field. Having to deal with hyper-competitive, socially inept or awkward, and often tactless peers is off-putting, particularly if you have to do it alone.

References

- Ceci, S. J., & Williams, W. M. (2009) *The Mathematics of Sex: How Biology and Society Conspire to Limit Talented Women and Girls*. United States of America: Oxford University Press.
- Hyde, J.S., Fennema, E., & Lamon, S.J. (1990). Gender Differences in Mathematics Performance: A Meta-Analysis. *Psychological Bulletin*, 107(2), pp 139-155.