

TEACHER-FACILITATOR MATERIALS FOR CORNELL INSTITUTE FOR
WOMEN IN SCIENCE VIDEO SERIES

14-YEAR-OLD GOOGLE SCIENCE FAIR WINNER, LAUREN HODGE

Although a significant gap in average mathematics performance existed in the U.S. during the 1970s, Janet Hyde and her colleagues have found that girls have now reached parity with boys in average performance, even in high school. This calls into question theories of sex differences in math performance that were developed to explain this gap that were based on the presumed biological superiority of males. How can males be biologically superior if the mean sex gap has disappeared? Doesn't this show that math performance is heavily influenced by cultural factors such as the changing expectations of females and the resultant numbers and types of courses they take? Let's look at some of the data from the U.S. before delving into international data.

Many researchers have suggested that the sex parity among average scores is not the most important factor. Rather, the critical factor is how the sexes perform at the elite level of mathematics, because mathematicians and scientists score in the very elite range, not the average range. If males outnumber females at the elite level, then this could explain why fewer females are found in math-heavy fields such as engineering and physics and females are more likely to be found in biology, as Lauren Hodges teacher noted.

In the early 1980s, of students under thirteen years of age who scored in the very elite range on mathematics tests (the top 1 in 10,000!), males outnumbered females 13 to 1. However before leaping to the conclusion that this indicates males are innately better at math, this ratio has been steadily declining over the years. By the mid 1990s it had sunk to approximately a 3 to 1 in the ratio of U.S. boys to girls. Similarly, the percentage of Ph.D.'s in the mathematical sciences awarded to U.S. women has increased from 6 percent in the 1960s to roughly 30 percent in the past decade. Granted, males outnumber females in these categories but the rapidity and size of the changes strongly suggests that cultural, not biological, factors are influencing elite performance. Perhaps the changes are not yet finished and we will observe a continuation of the reduction in the sex gap in elite performance in the coming decades. What are some of the cultural factors that influence sex differences in math performance? To address this question, let's look at the international picture.

International Competitions

Researchers use an measure of gender egalitarianism called the Gender Gap Index (GGI) to reflect the differences between men and women in such areas as economic participation, educational attainment, political empowerment, and health. The GGI is negatively correlated with both the gap in average mathematics performance between boys and girls and the ratio of boys to girls scoring above the top 5% on international

math tests. Also, in some countries with high GGI indexes (gender equality), the ratio of boys to girls at the top 5% is essentially 1:1, meaning no gap.

At an even more elite level, the percentage of worldwide participants who are girls in the International Mathematical Olympiad has increased from approximately 21/2% in the 1970s to 10% in recent years (see PDF by Nathan Kane & Janet Mertz, 2011). There is also a positive correlation between GGI and the number of girls with profound mathematical talent as measured by percentage of girls who participated in the IMO as members of high-ranked teams. So, those cultures that exemplify the greatest gender equality also exhibit the smallest sex gap in mathematical performance, suggesting that non-biological factors are very important.

- In this video Lauren's science teacher (the man getting a haircut) says that female students have always been interested in science but they tended to prefer biology and chemistry instead of physics and engineering. Why do you think females would prefer biology over, say, engineering?
- Lauren Hodges is obviously a smart and motivated young woman.. To what extent do you think that many of her female peers could attain the same accomplishments? That is, is she special or is she lucky to have parents who are highly educated and motivated and involved in her schooling?
- Just because one the environment matters hen it comes to mathematics doesn't mean that biology does not matter as well. Can you think of an example showing why this is true? For example, in an environment that provides free eyeglasses, free lunch, etc. students who otherwise might fall behind are allowed to thrive, but this does not mean their visual problems had no biological basis.

Recommended Readings:

Kane, J. M. & Mertz, J. E. (2012). Debunking myths about gender and mathematics performance. *Notices of the American Mathematics Society*, 59, 10-21.