US culture derails girl math whizzes

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A culture of neglect and, at some age levels, outright social ostracism, is derailing a generation of students, especially girls, deemed the very best in mathematics, according to a new study.

In a report published today (Oct. 10) in the *Notices of the American Mathematical Society,* a comprehensive analysis of decades of data on students identified as having profound ability in math describes a culturally constricted pipeline that puts American leadership in the mathematical sciences and related fields at risk.

According to the report, many girls with extremely high aptitude for math exist, but they are rarely identified in the U.S. because they veer from a career trajectory in the mathematical sciences due to the low respect American culture places on math, systemic flaws in the U.S. public school education system, and a lack of role models.

"The U.S. culture that is discouraging girls is also discouraging boys," says Janet Mertz, a University of Wisconsin-Madison professor of oncology and the senior author of the study. "The situation is becoming urgent. The data show that a majority of the top young mathematicians in this country were not born here."

Joseph A. Gallian, a co-author of the report, a professor of mathematics at the University of Minnesota, Duluth, and current president of the Mathematical Association of America, says, "Just as there is concern about the U.S. relying on foreign countries for our oil and manufactured goods, we should also be concerned about relying on others to fill our

needs for mathematicians, engineers and scientists."

Mertz and Gallian conducted the analysis with Jonathan Kane, a professor of mathematics and computer science at the University of Wisconsin-Whitewater involved with math competitions, and Titu Andreescu, a professor of mathematics education at the University of Texas at Dallas. Andreescu is a former leader of the U.S. International Mathematical Olympiad team and director of AwesomeMath, a summer program for mathematically gifted children.

The new study draws on decades of data from extremely difficult mathematics competitions aimed at the most elite student math performers, including the collegiate William Lowell Putnam Mathematics Competition and the pre-collegiate International and U.S.A. Mathematical Olympiads.

Mining the data, Mertz and her colleagues found:

Contrary to the myth that females lack the intrinsic aptitude needed to excel in mathematics at the highest level, an idea proffered most famously by former Harvard University President Lawrence Summers, many girls exist with truly exceptional talent for mathematics.

Girls as well as boys with such talent are frequently identified and nurtured in some countries where this ability is highly valued; in the U.S., such talent is routinely overlooked or ignored, with many American boys and girls feeling they are actively discouraged from excelling in math.

American children of immigrants from countries where math talent is highly valued — notably Eastern Europeans and Asians — are much more likely to be identified as possessing extraordinary mathematical ability.

The pipeline for nurturing top math talent in the U.S. is badly broken beginning at the middle school level. Eighty percent of female and 60 percent of male faculty hired in recent years by the very top U.S. research university mathematics departments were born in other countries.

"We show," the group reports, "that many girls exist who possess extremely high aptitude for mathematical problem solving. The frequency with which they are identified is due, at least in part, to a variety of socio-cultural, educational or other environmental factors that differ significantly among countries and ethnic groups and can change over time."

When raised in some environments, girls were found to be 11-24 percent of the children identified as having profound mathematical ability; when raised in others, girls, including U.S.-born white ones, were 30-fold or more underrepresented. Andreescu believes that, "Innate math aptitude is probably fairly evenly distributed throughout the world, regardless of race or gender. The huge differences observed in achievement levels are most likely due to socio-cultural attributes specific to each country."

"We are wasting this valuable resource," says Mertz. "Girls can excel in math at the very highest level. There are some truly phenomenal women mathematicians out there."

In elementary school, girls do as well as or better in math than boys. In middle school, Mertz and her colleagues suggest, girls with an inclination for math begin to lose interest and fall behind, mostly due to peer pressure and societal expectations. Throughout middle and high school, social stigma and lack of appropriately challenging educational opportunities for the mathematically precocious becomes a hard reality in most American schools. Consequently, gifted girls, even more so than boys, often camouflage their mathematical talent to fit in well with their

peers.

In the future "flat world," the U.S. may no longer be able to depend upon hiring foreign workers to fill its jobs in the mathematical sciences and related fields. The report suggests that the economic well-being of the U.S. is at risk, and that it is crucial that steps be taken now to correct this problem. A good start, say Mertz and her colleagues, would include implementing the recommendations of the National Mathematics Advisory Panel and fully funding the America COMPETES, "10,000 Teachers, 10 Million Minds" and Sowing the Seeds through Science and Engineering Research Acts already passed by the U.S. Congress.

Source: University of Wisconsin-Madison