UC Newsroom

Girls' and boys' math performance now equal

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BERKELEY --
Girls now equal the performance of boys on standard mathematics assessment tests, probably because girls now match boys in the number and level of math courses they take in elementary and high school, according to a new study by researchers at the University of California, Berkeley, and the University of Wisconsin, Madison.

That wasn't the case 20 years ago, when studies showed nearly identical performance at the elementary school level but girls lagging boys at the high school level. Since then, girls' participation in higher level mathematics classes has risen to the same level as boys', with predictable results, according to study co-author Marcia Linn, UC Berkeley professor of education.

"In the past, there were differences in test scores, and women took fewer advanced courses in mathematics than men," she said. "Now that enrollment in advanced math courses is equalized in high school, we don't see gender differences in performance on state tests."

The Wisconsin and UC Berkeley researchers report their findings in the July 25 issue of *Science*.

Funded by a grant from the National Science Foundation, the researchers reached their conclusions after sifting through mountains of data, including math scores from 7 million students who were tested in accordance with the federal No Child Left Behind Act (NCLB). The team compared not only the average performance of all students on these tests, but also the scores of just the most gifted children, as well as the ability of children to solve complex math problems. In all cases, girls measured up to boys.

Persistent math stereotypes

Study leader Janet Hyde, a psychology professor at UW-Madison, noted that, despite the fact that girls now take just as many advanced high school math courses as boys, and women earn 48 percent of all mathematics bachelor's degrees, the stereotype persists that girls struggle with math. Not only do many parents and teachers believe this, but scholars also use it to explain the dearth of female mathematicians, engineers and physicists at the highest levels, Hyde said.

Such cultural beliefs are "incredibly influential," she said, making it critical to question them. "If your mom or your teacher thinks you can't do math, that can have a big impact on your math self-concept."

Linn and Hyde have long collaborated on studies of gender differences in math and science learning, including an analysis that appeared in Science in 2006 that showed that differences in math performance were far greater between different cultures than between men and women. For example, Japanese and Taiwanese children perform far better on math tests than do American children, irrespective of gender.

For their current study, the team acquired math scores from state exams now mandated annually under No Child Left Behind, along with detailed statistics on test takers, including gender, grade level and ethnicity, in 10 states. Using data from more than 7 million students, they then calculated the "effect size," a statistic that measures the degree of difference between girls' and boys' average math scores in standardized units.

The effect sizes they found -- ranging from 0.01 and 0.06 -- were basically zero, indicating that the average scores of girls and boys were the same.

"Boys did a teeny bit better in some states, and girls did a teeny bit better in others," said Hyde. "But when you average them all, you essentially get no difference."

Some critics argue, however, that even when average performance is equal, gender discrepancies may still exist at the highest levels of mathematical ability. To account for this possibility, researchers compared the variability in boys' and girls' math scores, the idea being that if more boys fell into the top scoring percentiles than girls, the variance in their scores would be greater.

Again, the team found little difference, as did a comparison of how well boys and girls did on questions requiring complex problem solving. What the researchers did find, though, was a disturbing lack of questions that tested this ability. In fact, they found none whatsoever on the 10 state assessments for NCLB, requiring them to turn to another data source for this part of the study.

What this suggests, said Hyde, is that if teachers are gearing instruction toward states' NCLB assessments, abilities in complex problem solving may drop in the future in both boys and girls, leaving them ill-prepared for careers in math, science and engineering.

"The tests we are currently using are really not asking students to perform the types of tasks they are likely to encounter in the workforce," Linn said. The lack of complex problems on assessment tests "doesn't motivate teachers or textbook developers to create material that challenges students, and it sends the wrong message to schools with regard to what should be emphasized in math courses."

Review of SAT scores

The study's final piece was a review of the granddaddy of all high school math tests, the SAT. The fact that boys score better on it than girls has been widely publicized, contributing to the public's notion that boys truly are better at math. But Hyde and her co-authors think there's another explanation: sampling artifact.

For one thing, since it is administered only to college-bound seniors, the SAT is hardly a random sample of all students, the researchers noted. What's more, greater numbers of girls take the test now than boys because more girls are going to college.

"So, you're dipping farther down into the distribution of female talent, which brings down the average score," said Hyde. "That may be the explanation for (the results), rather than girls aren't as good as boys in math."

While girls have reached parity with boys in enrollment in math classes, Linn said, girls still are underrepresented in advanced science courses such as physics and in careers in physical science and engineering that require knowledge of physics and mathematics.

In a July 16 talk before the Congressional Science Technology Engineering & Math Education caucus, Linn discussed the trends in mathematics performance and called for increased emphasis on science courses where women are underrepresented. She called for attention to improving the quality and enrollment of women in science courses and emphasized the opportunity to use new technologies, such as simulations of complex processes, to strengthen course content.

The study's other authors, all from UW-Madison, are graduate students Sara Lindberg and Carolyn Williams, and assistant professor Amy Ellis of the Department of Curriculum and Instruction.