Even when women outnumber men, gender bias persists among science undergrads

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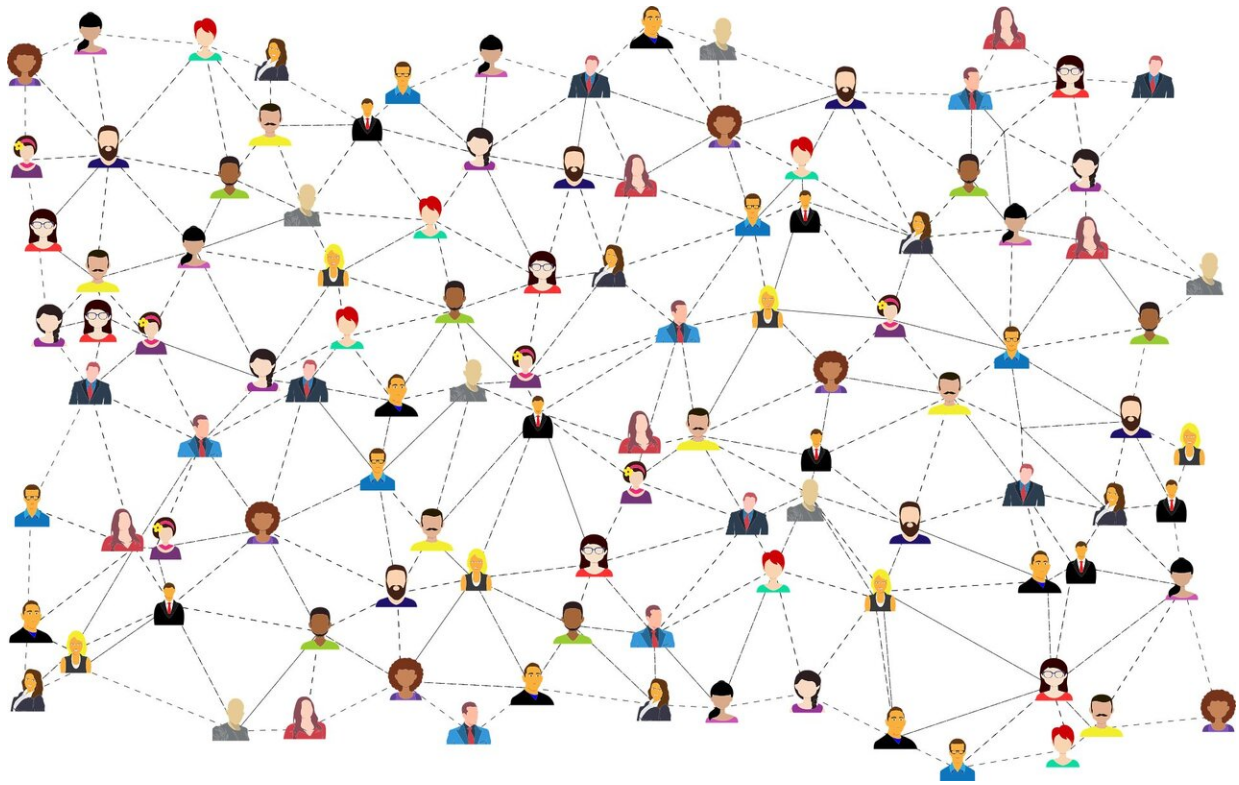

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Increasing gender diversity has been a long-sought goal across many of the sciences, and interventions and programs to attract more women into fields like physics and math often happen at the undergraduate level.

But is representation enough to improve gender diversity in science? In a new study, Colorado State University researchers say there's more to the story: They've found that even when undergraduate women outnumber men in science courses, women may still be experiencing gender biases from their peers.

The CSU team, combining expertise in gender psychology, instructional intervention and physical sciences, conducted a survey-based study among both physical and life science undergraduate courses at CSU, asking students how they perceived each other's abilities within those courses. Their results were published online June 25 in the journal *PLOS ONE.*

"The assumption has been that if you have the numbers, if you just increase the number of women, you won't have bias," said study co-author Meena Balgopal, professor in science education in the CSU Department of Biology. "But we find that's not the case."

For their study, the researchers focused on courses with a peer-to-peer learning component, such as group lab work, partner work or breakout sessions during lectures. They recruited instructors to administer surveys asking students how they perceived each other, with questions including: Are there any students in your class you are more likely to go to if you need help with the class? Thinking about your course, do any students stand out as particularly knowledgeable? Thinking about your course, who would you consider to be the best student(s) in the class? In total, they surveyed about 1,000 students.

Outnumbered and undervalued

Here's what the researchers found: In physical science classes—where women are more traditionally underrepresented—women were indeed outnumbered, and they had higher average GPAs, statistically higher

course grades, and were 1.5 times more likely to earn an A or A-plus than men. However, the researchers found that both men and women presumed that the men in the class outperformed the women. In these classes, both women and men were less likely to select a woman as someone they would seek help from, find knowledgeable, or perceive as best in the class.

They saw a similar, albeit lesser effect in life science classes, where, in contrast to physical sciences, women tend to outnumber men, particularly in biology classes. In their study results, women both outnumbered and outperformed men in terms of GPA and statistically higher course grades. In these courses, men were equally likely to identify a woman or a man in all categories such as someone they'd seek help from, or find knowledgeable, or consider best in the class, and women identified women and men equally only in the category of "best in the class."

The researchers acknowledged limitations in their study: Although the surveys allowed participants to self-identify their own genders, when they referred to classmates, the researchers only recorded how students perceived the genders of their classmates. They also found that the surveys were not representative of the overall demographics of the courses; students who chose to answer the surveys were more likely to be STEM majors, white students, physical science students, and students with overall higher class grades and GPAs.

Also, while they wanted to perform intersectional analyses for women of color or gender minorities and how their peers perceived them, they did not have a large enough sample to draw meaningful conclusions from the data.

The researchers were inspired to conduct the study after a 2016 study by University of Washington researchers found a pro-male bias for ratings

of students' abilities among male students in undergraduate biology courses. The CSU team wanted to see if the same effect could be found here, and their choice of methodology was intentionally similar.

Learning from the results

Balgopal said from an instructional design point of view, their results could reveal opportunities for more thoughtful attention to things like group work, and how instructors guide active learning.

"It would be really interesting to understand where these biases originate," said Balgopal, who, along with co-author A.M. Aramati Casper, is interested in pedagogical interventions that improve classroom learning outcomes.

For first author and gender psychologist Brittany Bloodhart, the most striking aspect of the study was not that gender bias persists among undergraduate STEM students, but that it's happening at the same time when women are consistently outperforming men in these fields, rather than being negatively affected in performance.

Among the research that shows girls and women are better in STEM, it's often discounted in various ways—girls work harder, are more attentive in class, study more, etc., which leads to better grades, Bloodhart said. When women perform worse than men on standardized tests, some claim that this reflects a difference in natural ability because they consider such tests the "real" measures of STEM ability. However, many studies support the view that standardized tests are also biased, and a poor predictor of actual STEM ability.

There is also a "variability hypothesis," which says that on average, girls and women have better outcomes in STEM than boys and men, but there is less variation in women's natural STEM talent compared to men.

"Our study refutes that variability hypothesis," Bloodhart said. "We didn't find any evidence that men were more variable than women or that they were more likely to get the top scores."

More information: Brittany Bloodhart et al, Outperforming yet undervalued: Undergraduate women in STEM, *PLOS ONE* (2020). DOI: 10.1371/journal.pone.0234685

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