

Widening participation in STEM requires an attitude change

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Students rule themselves out of, or in to, STEM (Science, Technology, Engineering and Mathematics) disciplines, based on stereotyped views of what makes a typical student, a new study has found.

New research from the University of Reading has found a social hierarchy in STEM, as well as narrow but differing views on the ideal or typical student in each discipline. These views are held by STEM students and are informed by wider societal opinions.

The findings, which are published today in *International Studies in Sociology of Education*, may explain why women, people of colour, and disabled students are underrepresented in some STEM subjects. To change this, attitudes must shift, say researchers.

Students think biology is easy, and physics is hard. How students speak about STEM subjects, themselves, and their fellow students, reveals the influence of patriarchy, white supremacy, classism, and ableism, on who can study, and excel in, biology, engineering, mathematics, or physics.

Dr. Billy Wong, Associate Professor at the University of Reading's Institute of Education, said: "Diversity in STEM is vital to ensure that research is designed to meet the needs of, and challenges faced by, all members of our communities.

"After making small gains in the numbers of women and minorities in STEM, over recent decades, we are still seeing huge disparities in most STEM subjects, except for biology and the [life sciences](#).

"Listening to students speak about STEM subjects has actually revealed a lot about the barriers to entry into non-biological sciences, mathematics, and engineering."

Dr. Wong and his team interviewed 89 students from two research intensive universities who all study one (or more) of four subjects: biology, physics, mathematics, and engineering. They asked the participants about the ideal student for their subject, and the three other subjects, versus the typical student.

Students in engineering, mathematics and physics were described using masculine-associated language, such as "analytical", "clever", and "resilient". Biology, on the other hand, is seen as a place for "collaboration", "work-life balance", and "passion".

Biology, where women are represented equally with men, is perceived as the easier STEM subject of the four.

Susie, a White British woman, studying engineering, was interviewed for the research. She said that a lot of engineering students, especially women, "don't know how good they are". She said: "They think that if they don't get the best marks ... they're not worth it because there's no one telling them, "hey, that's perfectly fine", because... there's a lot of focus on that first [class grade] being the be all and end all."

Francesca, a study participant and a Black British woman, studying physics said: "You've got to be passionate about physics because physics is hard. So, if you don't like it as much as you say you like it, you're probably going to tear your hair out and drop out within six months of doing the degree... you've got to have... mad resilience... you're going to be re-writing this code 20 times, re-doing that problem 20 times." She also said people in physics are normally "either white, or male".

Heather, a British East Asian woman interviewed for the research, said that the ideal biology student "asks questions if [they] don't understand anything", as well as giving "110% into their coursework [and] does extra reading in their spare time".

Odessa, a White British woman participant, said the typical biology student is "willing to work hard" and work "with other people ... on collaborative projects", at least partly because their "department puts a lot of emphasis on [wanting] to change the idea [that] scientists are people who are literally working by themselves in a lab". She said

"science is all about collaboration" and "people who are unsuccessful at biology aren't able to communicate".

Dr. Wong said: "It's unclear which came first, the view of biology as an easy subject, or the more equal representation of women in biological sciences. We do think it's likely that women are self-selecting out of non-biological sciences because they view them in masculine terms.

"This social hierarchy will also impact students with caring responsibilities or paid work, as well as disabled students. Members of these groups may think that taking on a 'hard' subject would require ways of being that are totally inconsistent with the demands of their lives.

"We have to make STEM subjects more inclusive and accessible to all and changing the image of who studies in each discipline would make a significant difference."

Dr. Wong and his team believe interventions to address these issues need to happen both at secondary school and in further and higher education. These might include efforts by higher education staff and the wider STEM community to challenge the hierarchy, through better mutual recognition of the values that different branches of STEM contribute. This would be greatly aided by opportunities for interdisciplinary working, say the researchers.

Interventions at an earlier point in education, perhaps in key stage 3, or GCSE science teaching could focus on broadening perceptions and popular view of who studies STEM subjects. Dr. Wong suggests teaching that STEM is not just for those who seem to reflect certain stereotypes. In fact, the ideal student in STEM is imagined to be quite diverse and this is something that students need to know, early on.

More information: Billy Wong et al, 'Biology is easy, physics is hard': Student perceptions of the ideal and the typical student across STEM higher education, *International Studies in Sociology of Education* (2022). [DOI: 10.1080/09620214.2022.2122532](https://doi.org/10.1080/09620214.2022.2122532)

Provided by University of Reading

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