

# THE *Current*

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## **‘Empathic education’ may unlock STEM learning success for all**

A more empathic approach to education — one that takes into account how learners prefer to receive content — may be key to STEM learning success, especially for underrepresented groups. In a paper published in the journal [Schools: Studies in Education](#), UC Santa Barbara professor [Sharon Tettegah](#) and collaborators assert that accessible, adaptable and supportive content that incorporates diverse ways of knowing “can create a more inclusive and effective educational experience for all.”

“Some people love going in and listening to a lecture and taking notes. For other people, talking heads just don’t cut it; they want to see other representations.” said Tettegah, a psychologist by training who directs the Center for Black Studies Research (CBSR), has a faculty appointment in the College of Creative Studies and holds positions at the Department of Computer Science, the Center for Responsible Machine Learning and the Center for Information, Technology and Society. “We all have preferences for how we receive or experience content,” she said.

This user-centered preferences perspective on STEM education is a different approach. Research in the engineering education and other STEM disciplines tend to focus on the presentation of information through lecturing, and the measurement of what is learned through primarily testing using equations and word problems. Somewhat less understood is how students prefer to receive the content that they are learning. This is the gap Tettegah found herself facing when contemplating the outcomes of programs meant to broaden participation in the STEM fields.

“So I was like, ‘okay, what’s going on?,’” she recalled. “They’ve (researchers) looked at varying instruction and learning, such as, cooperative learning and they’ve brought in remedial courses.” Despite all that, some women and people of color continue to lag in some STEM fields, such as engineering and math, dropping out of programs before they can turn them into careers.

There are several reasons for this, say Tettegah and collaborators, Jessica Young at University of Notre Dame, Dave Vallett at analytics company Sportlogiq, Alan B. Craig at University of Illinois and Yingtao Jiang at University of Nevada. Postdoctoral researchers Ebenezer Larnyo and Charles Terry, at the CBSR also contributed to the paper but were not part of the research team. In their paper, they cite “inadequate financial investments across school systems,” and a lack of diverse representations of content.”

“If you had a traumatic event as a child with content that’s represented in a particular way, then that’s going to be a trigger for when you go on to college,” said Tettegah, whose research focuses on teaching and technology.

The researchers conducted experiments to test their hypothesis that the underrepresentation of women and students of color in engineering stems from Eurocentric/White-centric values and learning approaches embedded in existing engineering curricula. Using focus group questionnaires, they surveyed 982 individuals, however this publication focuses on 102 undergraduate engineering students at three universities regarding their preferences for learning of STEM content. The researchers also conducted tests to measure creativity, or how the students explore different solutions to problems. Concurrently they conducted a data mining project involving a survey of engineering curricula and course catalogues to help inform the content they focused on for the study, while also examining course syllabi to determine how this content was represented, such as via books or articles, simulations or graphics.

Their initial investigations uncovered some “intriguing insights,” the authors noted. According to the paper, Black students tended to favor textual material over visual aids. White and Asian students, meanwhile, tended to prefer line and pseudorealistic illustrations. Hispanic/Latino students favored diagrams and illustrations equally and showed the least preference for equations. The researchers’ observations also suggest that there is a discrepancy between instructors’ teaching methods and the

preferences expressed by the learners, one that can be fixed with a variety of representations of the same concept.

“You can have text like word problems, you have equations and you have 2- and 3D diagrams, you have animations and interactive simulations,” Tettegah said. “Ideally, we should be in a classroom and use all these different representations to be more engaged with the concepts we are teaching.” Engagement, or lack thereof, often becomes a make-or-break situation during students’ sophomore and junior years, when STEM curricula intensify. At that point, many underrepresented students, among others, will tend to drop their engineering major.

This work scratches the surface of the researchers’ exploration into creativity, pedagogy and equity and equality for equity and equality for all students, specifically learners with diverse epistemologies; there’s more to come, Tettegah said.

“Bottom line, it’s about the diverse preferences we bring to the classroom,” she said. “And once we get the diversity in curricula represented the classroom, then you’ll get the diversity in students eventually, because it’s going to filter up.”

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