Interrogating the center of STEM education: toward an equity-minded undergraduate educational system

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Striving for Inclusion in Academic Biology Series
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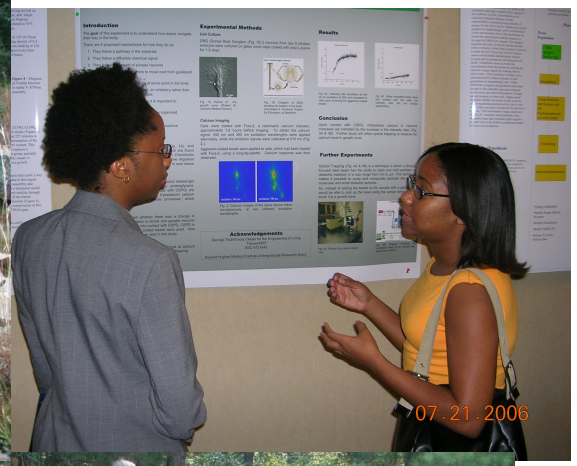
Visiting Professor
Applied Biotechnology Unit
University of Dar es Salaam
1999-2000



Biology Department Chair
Spelman College, Atlanta, GA
2005-2009

Terminology

PEER – Person Excluded due to Ethnicity or Race

Marginalized – to be assigned a position peripheral to rather than centered within educational mission and system

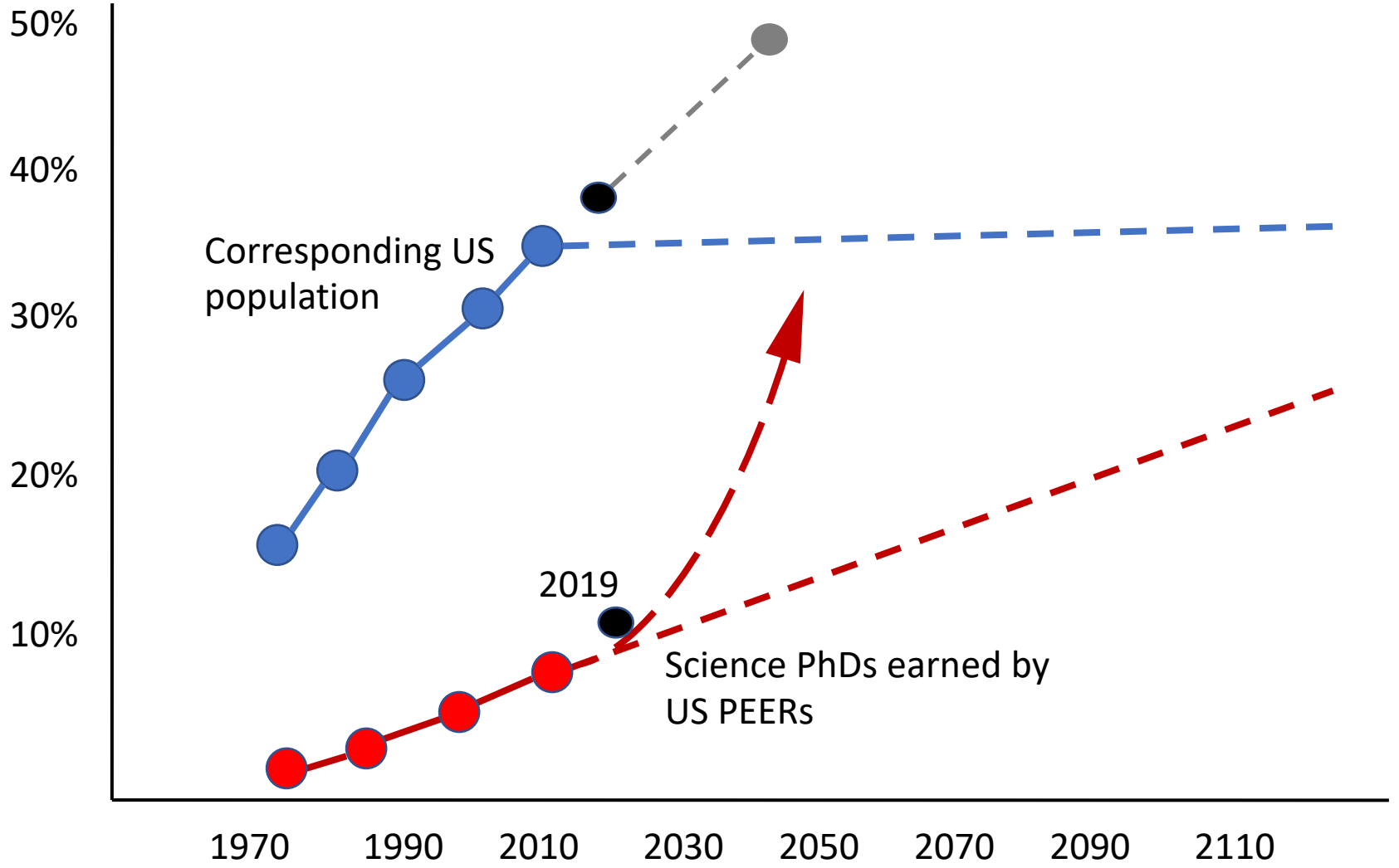
Queer – encompassing persons who do not identify as exclusively straight and/or those who have non-binary or gender expansive identities.

HWI – Historically White Institution

Why is it important to consider a broad definition of diversity to make academic Biology inclusive?

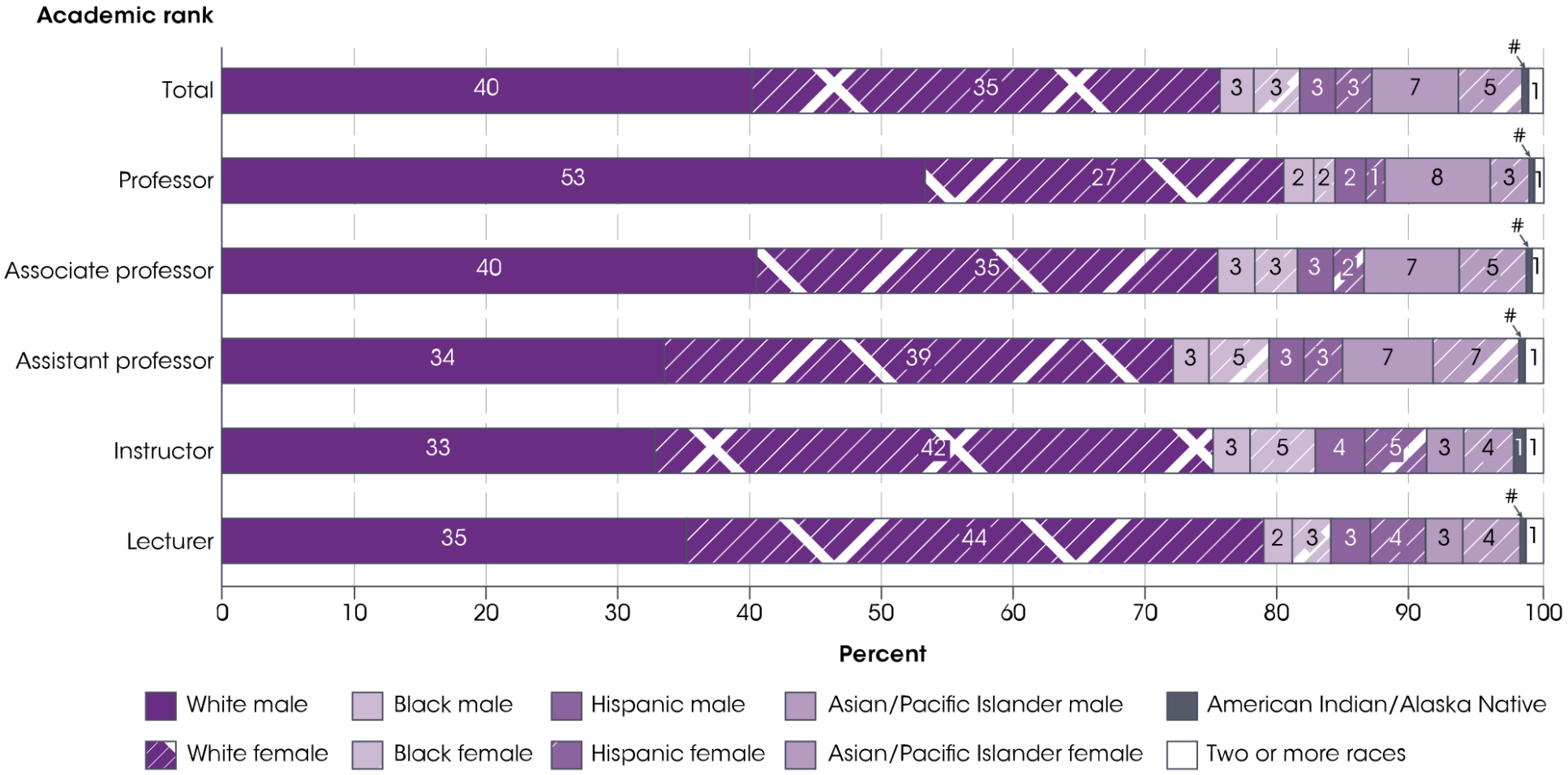
- Parity – a STEM enterprise that represents the citizenry of the US

Achieving Parity in the U.S. STEM Workforce



NSF Survey of Earned Doctorates, http://www.nsf.gov/statistics/srvydoctorates/
U.S. Census Bureau, http://www.census.gov/

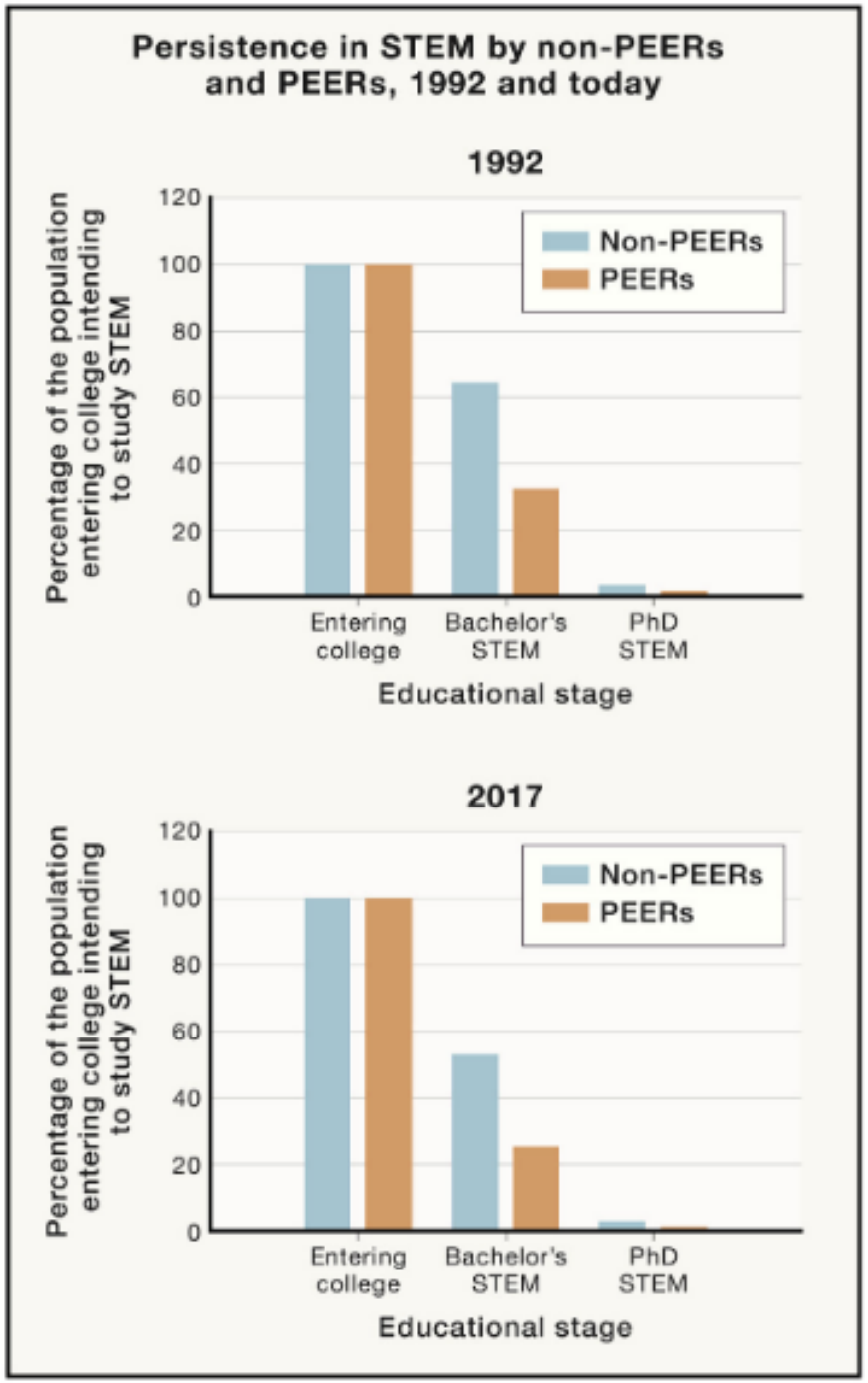
FT faculty at degree-granting postsecondary institutions (Distribution by race/ethnicity and sex, Fall 2018)



https://nces.ed.gov/fastfacts/display.asp?id=61

Why is it important to consider a broad definition of diversity to make academic Biology inclusive?

- Parity – a STEM enterprise that represents the citizenry of the US
- Innovation – develop the full spectrum of STEM talent in the US

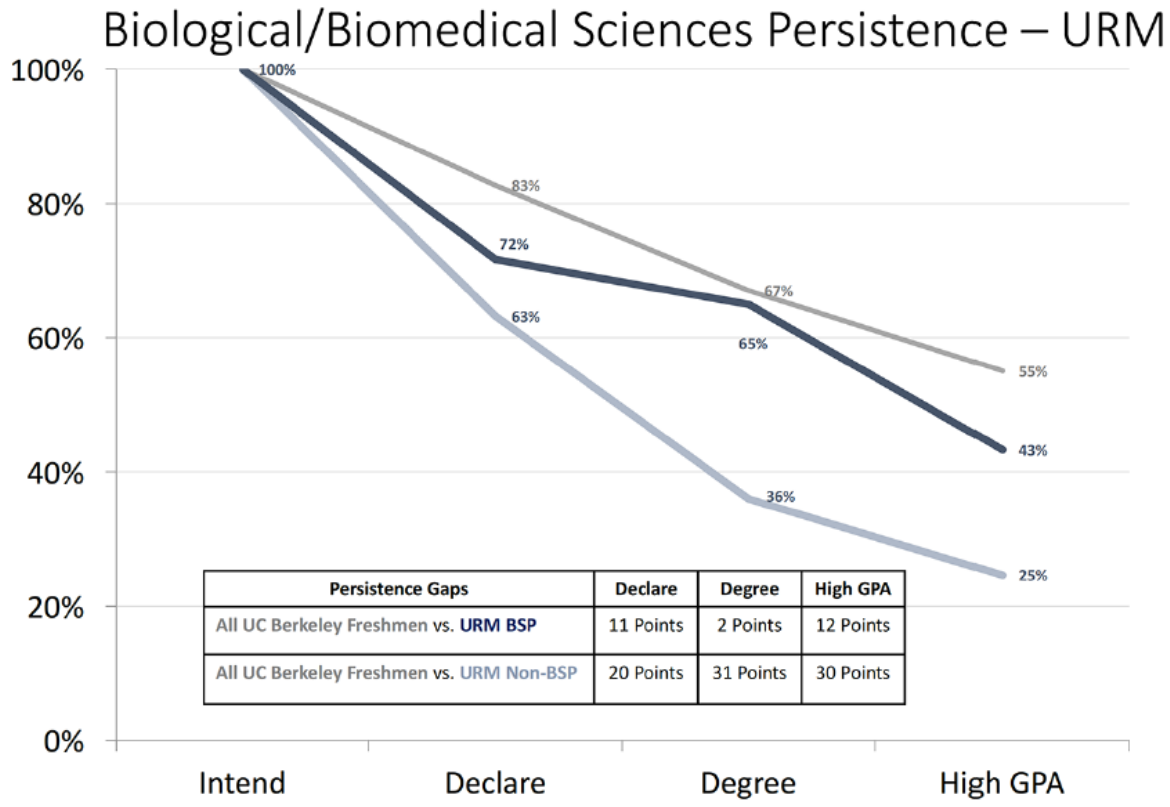


"The pattern of PEER/non-PEER persistence is essentially the same as it was nearly three decades ago."

Asai, D. 2020 https://doi.org/10.1016/j.cell.2020.03.044

(data from NCES, 2019)

Students “from backgrounds that *least* fit the profile of historically successful students” can succeed in STEM.



Persistence Gaps	Declare	Degree	High GPA
All UC Berkeley Freshmen vs. URM BSP	11 Points	2 Points	12 Points
All UC Berkeley Freshmen vs. URM Non-BSP	20 Points	31 Points	30 Points

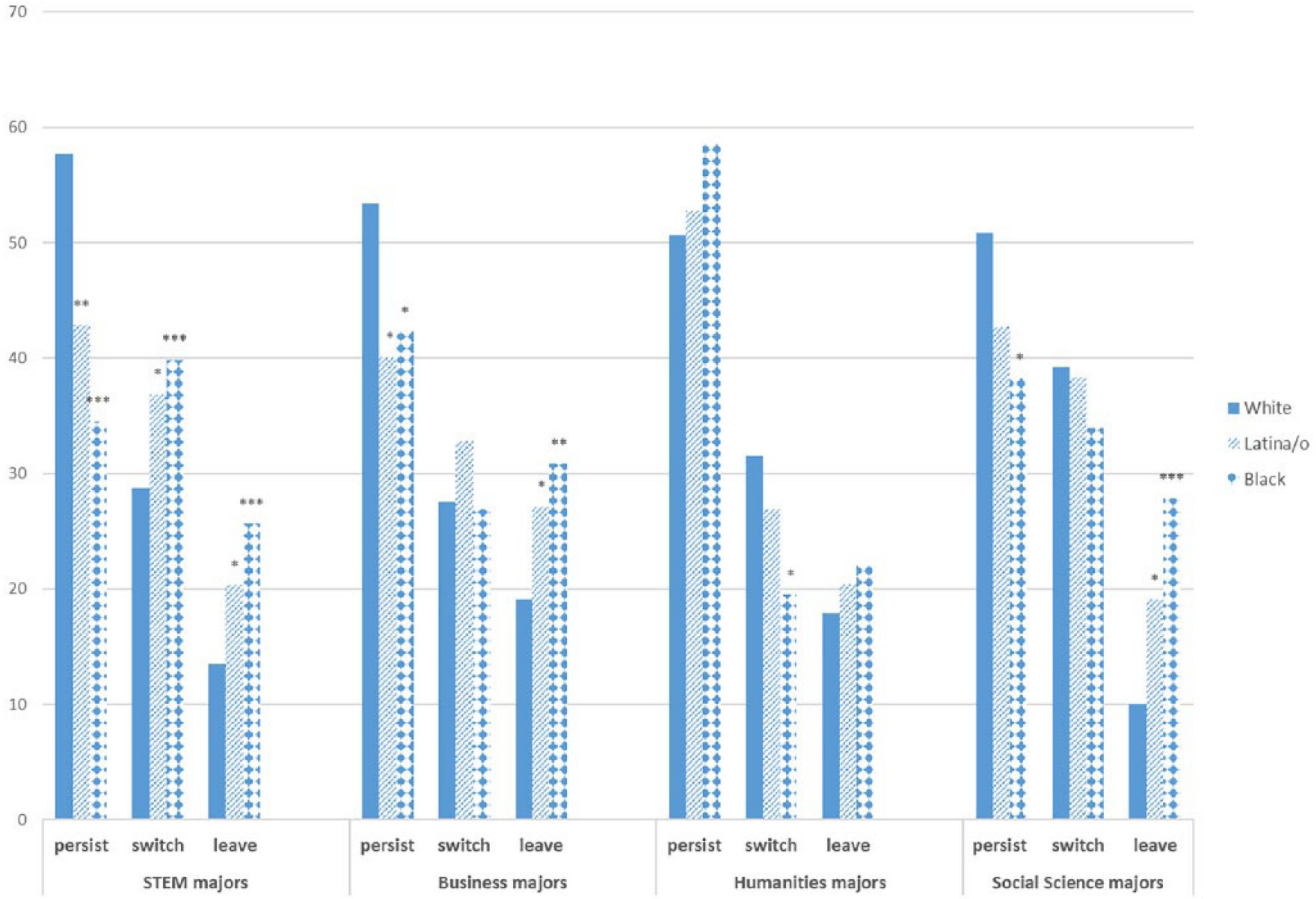
Note: 2002-2008 entering freshmen cohorts, intended biological and biomedical sciences majors at UC Berkeley
Andrew Eppig, UCB Office of Equity & Inclusion

Matsui, LSE 2018, https://doi.org/10.1187/cbe.17-12-0276

Why is it important to consider a broad definition of diversity to make academic Biology inclusive?

- Parity – a STEM enterprise that represents the citizenry of the US
- Innovation – develop the full spectrum of STEM talent in the US
- Equity – all students can have rewarding STEM educational experiences

STEM fields generate unique racial/ethnic gaps in student persistence



*p < .05. **p < .01. ***p < .001.

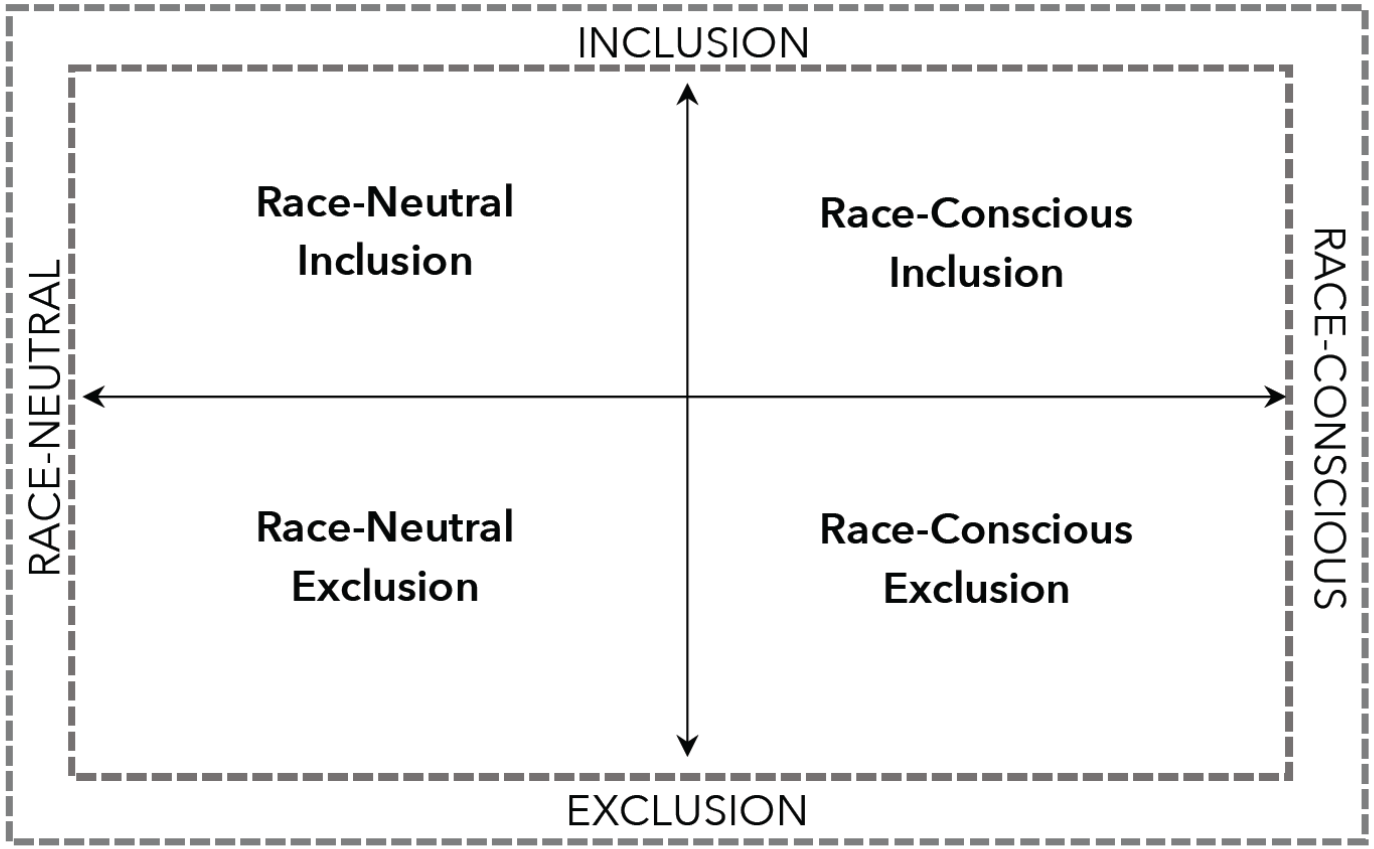
Indeed, we find these gaps the most troubling, as they reveal a comparatively high probability of exit from college specific to minority youth who enter college as STEM majors. In summary, we find evidence of White privilege in STEM degree attainment that is not mirrored in other major fields.

Riegle-Crumb et al, 2019
https://doi.org/10.3102/0013189X19831006

Racial inequities in STEM are not a natural disaster that befell the U.S.; they were created intentionally and justified by white supremacist beliefs that were the cornerstone of our nation.

Malcom-Piqueux, 2020

Equity Quadrant as an Organizing Framework



(Malcom-Piqueux, 2020)

Centering Equity in STEM education reform

- Actively acknowledge inequality and discrimination exists
- Prioritize equity-based metrics for measuring effectiveness (McNair, Bensimon and Malcom-Piqueux, 2020):
  - Success of PEER and other marginalized students
  - Elimination of educational inequities
- Re-center science learning on inclusion (Asai, 2020)
- Frame diversity as an essential component of educational excellence
- Incorporate positionality as an essential component of educational approach

Students manage their identities and connections in the learning context

- Student social identities and saliency impact participation in active-learning classrooms (Eddy et al, 2015 LSE; Hurtado et al, 2015; Cooper and Brownell, 2016)
- Affirming social inclusion provides a context for STEM student persistence (Estrada et al, 2018; Estrada et al, 2019)
- Social networks, self-efficacy and science identity supports student persistence in FGCS and PEERs (Chen et al, 2020; Dika and D'Amico, 2015; Martin et al, 2020)

Intersectionality matters.

- Experiences of Black women and girls in STEM (Ireland et al, 2018)
- Intersectional analysis of science identity (Byars-Winston and Griebel Rogers, 2018)
- Motivation and performance in students who are PEERs (Jackson et al, 2016)

> “To truly understand what needs to be done we have to address these issues with nuanced perspectives that cannot be captured through broadly drawn dimensions of gender or race. We must recognize that our students don’t want to be captured that way.” (Mack et al, 2014)

How can we apply equity-mindedness to re-center STEM education?

Inclusive Teaching for Equity in STEM Education

- Instructor self-awareness
- Instructor empathy
- Affirming classroom climate
- Inclusive pedagogy
- Leveraging support networks

"Inclusive teaching is not a style, but a philosophy that forms the basis of a pedagogy that recognizes the whole person." (Dewsbury and Brame, 2019)

Faculty hiring for equity-based departments

How do departments present themselves to faculty candidates?

What values and objectives inform evaluation of candidates?

What conversation do new faculty hires step into?

Equity-focused faculty mentoring

How does faculty development reflect departmental values?

How do departmental faculty networks participate in mentoring?

How are mentoring interactions connected with departmental conversations about equity?

> “(D)ominant mentoring initiatives tend to replicate androcentric and Eurocentric values that center individualism within the context of traditional hierarchies.” (Endo, 2020)

Developing equity-minded STEM leaders

How do we develop self-reflective leaders who position themselves within a vision for institutional transformation and manage a strategy that sustains their work?

How do we understand the role of leaders in faculty development for equity?

How do we define characteristics of leadership which advance equity-based institutional practice?

Learning is about everything going on in the classroom.

Tanner, 2017

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